REFINER
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GEORGE REID
Editor

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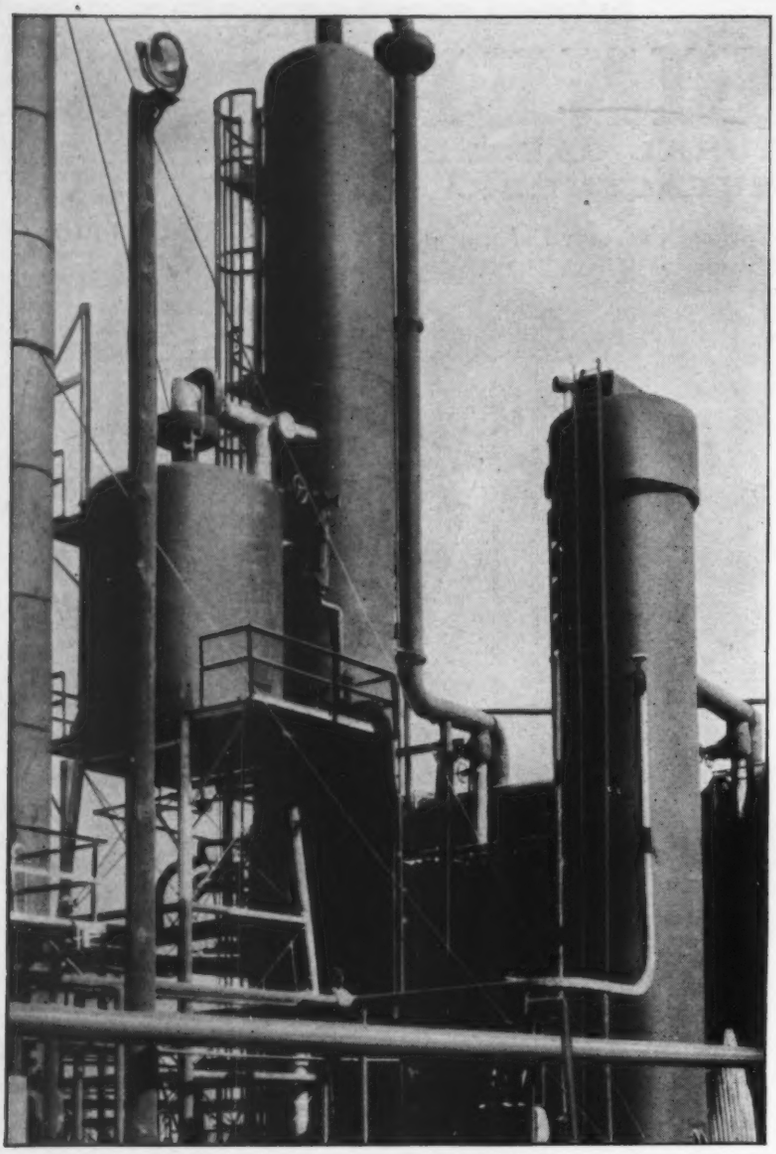

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AT RIGHT: These treating towers were insulated by Eagle-Picher's contracting division, using Eagle Blankets, Eagle "66" Plastic Insulation and Eagle Insulseal (waterproofing cement) on the after fractionating column; Eagle Fireproofing Concrete on the structural steel.

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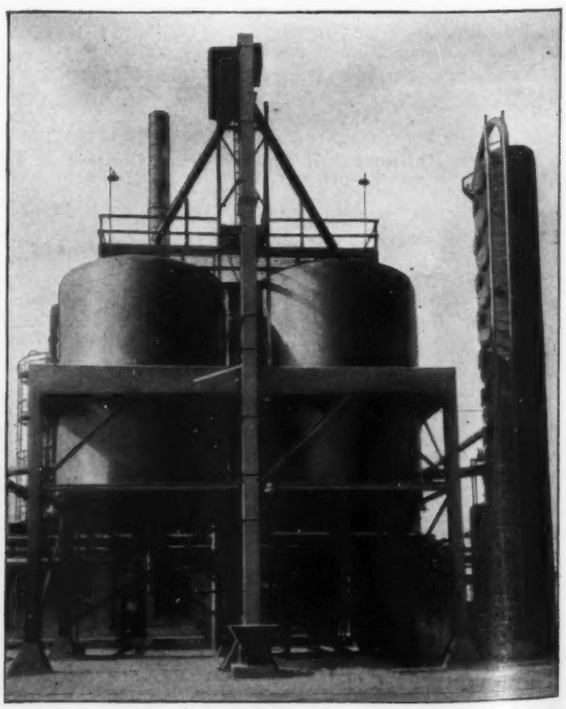

REFINER
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Tail Wagging

In the attempts to secure and maintain control of oil production, refining and marketing so that prosperity may come to the industry, the principle success so far has been in control of production. In the refining branch of the industry the picture is none too bright, and is less bright in the case of marketing. To the present the industry seems more able to better control what it produces and buys than what it sells. Examples are the tardiness in completing the pool agreement at Washington, the deferring of the cartel in California, and the increase in gasoline stocks because refiners continue processing too much oil. Apparently about 95 percent of the industry has the courage to say that crude oil is worth so much per barrel, and stick to it. Unfortunately that same 95 percent seemingly is willing to permit the remaining 5 percent to name the selling price of refining products. When the sellers of refined oils become blessed with the same brand of courage and backbone that has been evidenced by the buyers of crude, the situation will proceed more steadily toward prosperity. But now, the tail keeps on wagging the dog.

800,000 Burners

Estimates presented at the recent convention of the American Oil Burner Association indicate a total of 800,000 domestic oil burners installed at the beginning of the year. Available figures for 1932 showed 733,100 domestic oil burners, consuming 40,840,000 barrels of oil valued at $120,769,600 at retail prices. A sizeable market for furnace fuels has developed over the past ten years (2,820,000 barrels in 1932), and authorities insist that the surface has only been scratched. W. H. Butler, Standard Oil Company of New Jersey, stated before the convention that if 25 percent of the 14,000,000 furnace-heated homes in the United States were equipped with oil burners, it would insure the petroleum industry a volume of domestic fuels about equal to that of present sales of gasoline. The larger oil companies are seriously studying the situation and it will not be surprising to find several such concerns, either directly or through affiliated companies, making early efforts toward exploiting both the indicated market for oil burning equipment as well as furnace oils. During the past two years several major industrial concerns have established oil burner manufacturing plants and sales organizations. Where one large oil company has led the way through an affiliated concern, others may soon follow.

Taxes and The Radio

The oil company employee should rejoice when his radio musical program may be interrupted by an announcer giving the public frank information on gasoline taxes. Experience has proven that gasoline taxes above a certain point definitely contribute to lowered consumption. Lowered consumption brought about by over-taxation may ultimately reduce employment in the industry whose products are so taxed. The dissemination of tax information is an excellent example of good use of the radio, and there are several high class radio programs under oil industry sponsorship—some of which now include tax information along with sales talks. Although each broadcasting can include only a few words on gasoline taxes, yet it will reach an audience that defies estimation.

The American Petroleum Industries Committee has released some interesting pertinent facts concerning 1933 gasoline taxes. Average rates for that year were equivalent to 38 percent of the retail price of motor fuel. Despite the highest rates in the history of the tax, collections for 1933 will be lower in dollars than in 1932. Three states having only a three-cent tax rate, California, Pennsylvania and New York, led in total collections. Substantial increases were recorded in the states having only a two-cent rate, Connecticut, Rhode Island, Missouri and the District of Columbia. State and federal governments received a sales tax amounting to 43.59 percent on all of the gasoline sold in the United States last year, and not withstanding the fact that the price of gasoline for the year averages more than a half-cent a gallon cheaper than during 1932, according to the most recent figures prepared by the committee.

After a Flea— There continually is such variance between the pessimism of the refined oil market situation and the optimism of the industry in general that one well might wonder. Gasoline prices as quoted in the spot market are uniformly so low that profitable operation would not be possible on the face of that return. Perhaps it is fortunate that there is such a direct route through so many units from the well to the consumer. With general business improvement being reflected from month to month in the volume of oil products consumed, the spot market, including products from "hot" oil, is becoming less and less important. Despite all the talk and excitement, it appears that branded products are moving profitably, except when the purveyors of those products turn to growl at the small element that is putting out bargain products—much like a dog after a flea it can not reach.

White Oils Larger quantities of medicinal and technical white hydrocarbon oils are used in this country than is generally realized. But few domestic concerns manufacture these oils and much of the demand is necessarily imported. A. L. Nugey discusses the characteristics of the various grades, their uses and the market needs. He presents information concerning plant equipment for their preparation and processing steps. Page 140.

Re-Using Contact Clays Not much work on the practical side of the problem of reactivating fine contact filter clays has been done, although many patents have been issued on solvent combinations for such a purpose. L. C. Trescott, in Part 2 of his series of articles on this subject, states that up to the present it has always been considered that the process would be too expensive. He presents information on plant equipment necessities, operating costs and possible results pointing to the fact that if solvent reactivation be carried out in a tight system under careful control then the process should be a practical and profitable procedure. Page 132.

Panhandle Gasoline The condition in the Texas Panhandle where sour gas is vented to the atmosphere after extraction of its relatively low yield of gasoline is provoking to some, satisfactory to others. The arguments have attracted attention to the area—and the condition which brought on the arguments contributed to the erection of several modern natural gasoline plants and the enlargement of others. Many good operating ideas have been found in these plants—some of which were presented in conjunction with descriptions of conditions and plants in the district in the February and March issues of THE REFINER. Other plant descriptions appear in this issue, and still others will follow next month.

Treating Distillates Cooke and Hayford continue their discussion of developments in chemical treatment of distillates presenting for the first time detailed information with regard to design, operation and results secured with the C. W. Stratford contactor-centrifuge acid treating process. The process is essentially a multi-stage, quick-contact centrifuge separation operation conducted on the counterflow principle. Combinations of this system with Gray Vapor phase process, the R. K. Stratford counter-current clay slurry process and the Osterstrom liquid phase clay treating process are discussed. Page 125.

Prices and Politics Congressional hearts, dilated by the stimulation of professional propagandists, are again bleeding for the poor public that buys gasoline. Much is made over the allegation that increased prices of the oil industry are out of proportion to increased costs brought about by higher wages paid under NRA regulations. Horror is expressed that there are differences in the price of gasoline as between sections. No mention is made of the fact that much of the cost of all gasoline is tax imposed by the same group that now cries about the cost.

How anyone, politician or propagandist, can estimate increased costs of a product incidental to the code is a question hard to answer. Estimating wage increases when statistics both on numbers of workers and pay scales before and after all are lacking, is a big problem. Contributing and associated industries also have increased their costs. Much of the added cost of gasoline has gone to the producer of the oil, the land and royalty owner. And in no instance has the advance in price been enough to even approximate the tax that governmental agencies impose.

Further, the oil industry contributes enough to the general welfare that it and its investors are entitled to its margin of profit. Oil followed the world into the depression, took its losses with the best of them, and now stands in the front rank of industries on the upgrade. No commodity is sold at a price more commenurate with value, and only the uninformed or those who deliberately are misinformed can make any criticism of the industry's rate of return.

Distillate Treating . . .

Now Highly Developed and Simplified

M. B. COOKE and A. W. HAYFORD
Director of Development and Research; and
Chief Chemist, Alco Products, Inc.

PART II

USE of sulfuric acid is very old, as has been pointed out, but here again, it was not an inherent defect of the acid which caused abnormal treating losses; it was lack of technique and machinery for its proper utilization. It remained for C. W. Stratford to introduce the necessary mechanical elements into sulfuric acid treating before the defects and major objections to the use of acid were overcome. Stratford invented and commercialized the short-time contact, rapid sludge separation process which was lacking in all previous processes. This was conducive to efficient desulfurization of petroleum distillates and in this field it appears to be an ideal process far in advance of other desulfurizing systems.

THE accompanying article constitutes Part 2 of the series dealing with distillate treating methods begun last month. The present discussion has to do with the C. W. Stratford contactor-centrifuge acid treating process and includes information as to its application, commercial plant operating data and experimental plant data.

Part 1 consisted of discussion of the Gray vapor phase process, the R. K. Stratford counter-current clay slurry process, and the Osterstrom liquid-phase clay treating process. Combination of these processes with the C. W. Stratford contactor-centrifuge acid process are discussed in the present writing.

V—THE C. W. STRATFORD CONTACTOR-CENTRIFUGE ACID PROCESS

The petroleum industry is well aware of the great advances which have been made in the distillation and cracking divisions. In fact, it is felt that this development so absorbed the refining technologists that treating did not receive its share of thought and development. With the discovery of large deposits of high sulfur crudes in West Texas, the treating problem received new impetus for a time but it did not develop into an active program due to the discovery of large deposits of sweet crude in Oklahoma and East Texas. The economic gains that can be won in improved treating methods are so great that careful consideration should be given to a rational program. Sulfur bearing crudes are being utilized even at present in large quantities and it is well known that cracked distillates and straight-run gasolines require specialized treating methods for the removal of sulfur compounds. It is gratifying to know that the ancient method of dumping acid into a cone bottom agitator and then blowing with air has been discarded because of insufficient mixing effect, long treating time and loss of valuable hydrocarbons. Agitators have been equipped with pre-mixers of the orifice type and increased efficiency has been the rule. In addition to this major step in advance, centrifugal pumps have been used for mixing acid and oil and circulating pumps added in other cases. The mixing problem was lessened by these developments but the one important point was apparently left unsolved; that of long time contact of sludge and acid by-products with the distillate under treatment.

A detailed review of the prior art in the refinery operation will show a marked tendency toward the use of mechanical energy for accomplishing satisfactory dispersion and contacting. The problem of quick separation of reaction products held by the sludge acid has only been solved by the introduction of the centrifuge as a separating means. The centrifuge is unquestionably the only device available today which gives rapid, continuous and substantially complete separation of distillates from acid sludge.

The combination of the counter-current acid treating principle with high speed dispersion mixers followed by centrifugal separation of sludge was made by C. W. Stratford and is finding increased use as justified by various economies made possible thereby. (REFINER, Vol. 11, No. 2, Process Number, Feb. 1932, page 178). In this system, the optimum conditions, such as degree of dispersion of acid and distillate, time of reaction and short duration of the time of contact of acid sludge with the distillate are readily attained. The need for this is apparent when it is recognized that the speed of chemical reactions and the limit to which such reactions may proceed are defined almost entirely by the temperatures at which the reactions occur, to the degree of dispersion and intimate contacting of the chemical components involved in the reaction and to

the period during which the chemical reaction is allowed to proceed before complete separation is made of treating agents from distillates. It is desirable to prevent the polymerization of valuable unsaturated hydrocarbons as far as possible. The Stratford process meets these requirements. It is also a fact that the counter-current method of contacting is conducive to minimum acid consumption and also to prevention of side reactions taking place. This is possible on account of the rapid separation of sludge acid at each stage. In this system the separated acid and distillate flow in opposite directions and as the acidity of the acid decreases, it is contacted with more highly reactive raw distillate. The fresh acid entering this counter-current flow system is contacted with distillate as it approaches the finishing stage.

The deleterious reactions previously mentioned are those little known but complex reactions that involve polymerization or condensation of the unsaturated hydrocarbons, formation of sulfuric acid or neutral esters with subsequent solution of the latter in the distillate. These reactions are accelerated by the presence of sulfuric acid and acid sludge and are known to occur within the period of several minutes. The more highly cracked the distillate under treatment, the greater the extent of these reactions. Heretofore, it has been practically impossible to desulfurize vapor-phase distillates successfully with sulfuric acid, owing to the extreme polymerization losses and high concentration of organic sulfuric esters in the distillate that cause troublesome emulsions, but by judicious selection of acid strength, contact time, temperature, immediate separation of reaction products many possibilities are opened up. It is important to obtain the optimum degree of treatment in minimum time and separate the acid treated distillate from the acid sludge as quickly as possible before such reactions have time to occur to any appreciable extent.

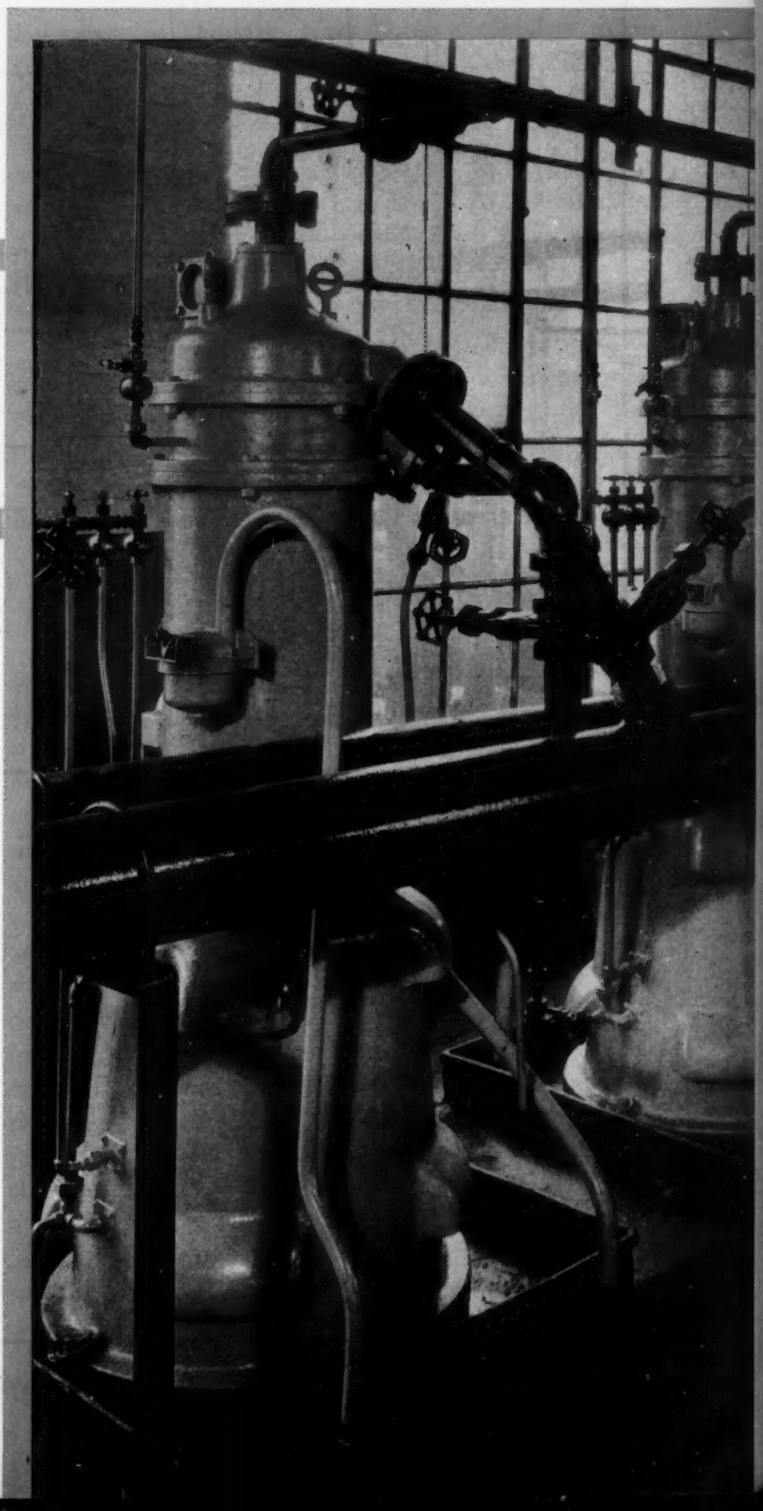
The Stratford process is essentially a multi-stage, quick-contact centrifuge separation operation conducted on the counterflow principle. In brief, the raw distillate enters the plant and receives a treatment with sludge acid from the following stage. The mixture is delivered immediately to the centrifuge where the sludge is separated from the distillate, the sludge passing out of the system and the distillate is pumped to the next stage where it is again contacted with either fresh acid

or sludge acid from the next following stage. Another contact and immediate separation of the components follows; the separated sludge again being pumped to the previous stage and the distillate delivered to the next stage for further treatment. Each treatment and separation is called a stage and the number of stages required will vary with the type of distillate being handled and the end-product desired. A 5000-barrel daily capacity three-stage Stratford treating plant, designed and erected by Alco Products, Incorporated, has been in operation at a large eastern refinery for over a year. A description of this installation and the results obtained will serve to illustrate the practical application of this process.

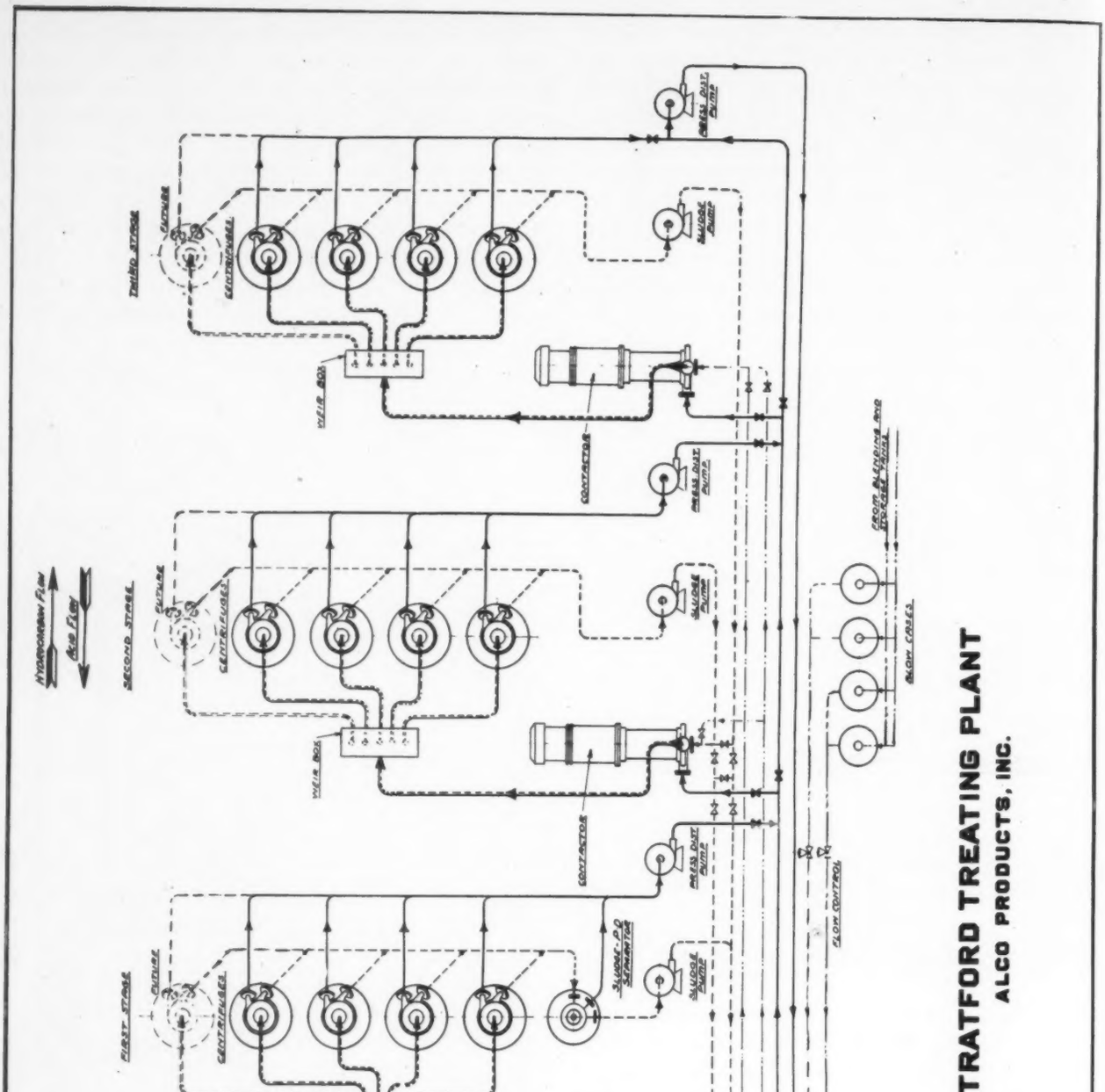
The distillate charged to the treating unit at the refinery mentioned is 100 percent West Texas, Dubbs and Cross pressure distillate containing 0.4 to 0.5 percent sulfur. It is necessary to produce a specification gasoline of 0.10 percent sulfur with minimum loss of octane and gasoline. In order to do this economically, three stages were required. It is definitely established by experimental work that the additional stages were justified as they represented a considerable saving of acid. It was found advisable to provide a cooler on the incoming distillate as the summer time temperatures are in excess of 90° F. Fortunately, well water at 60° F. is available at this plant. The size of the contactor and delivery lines were kept down to a minimum in order to reduce the time sludge is present in the distillate. For a charging capacity of 150 gallons per minute, the active contact time within the mixer is less than one second and the total time before separation is about three seconds.

The contactors used in this installation consist of a horizontal 8 x 12-inch shell having a multiblade propeller mounted on a shaft extending through a packing gland and directly connected to a motor. The internal arrangement is designed to produce intense mixing within a confined volume and is accomplished by a circulating tube around which the distillate passes many times a second. Fixed blades and baffles are used to prevent cavitation and to increase turbulence. By varying the speed of the motor, pitch of propeller or length of the circulating tube, it is possible to change the intensity of mixing, but for a given charging stock, the amount of contacting required will be fixed.

The outstanding features of the centrifuges used in this process are (a) high-speed direct motor-drive, (b) large bowl capacity, (c) vapor tight, (d) rugged construction. The adjustment that governs the thickness of the sludge layer formed within the bowl is made by inserting discs of different sizes in the sludge or distillate discharge throat. The feed enters a central tube through the top and is flung by throwing devices to the side of the bowl at the bottom of the bowl where high centrifugal force effects a separation of acid sludge from the distillate due to the difference of specific gravity of the two liquids. The separating effect is approximately 7000 times that of the gravity which permits a high throughput and yet obtains a clean separation. The unit capacity of these centrifuges is placed at 1500 barrels per day each but as high as 1800 barrels per day each have been successfully handled. Continuous runs for as long as three weeks are common with-



At the left is a view of a large installation of the C. W. Stratford contactor-centrifuge acid treating process. Hook-up of the individual unit is shown in the picture at the right. The centrifuges are high speed direct motor driven, have large bowl capacity and are vapor tight and rugged in construction.


STRATFORD TREATING PLANT
ALCO PRODUCTS, INC.
HYDROCARBON FLOW
ACID FLOW
THIRD STAGE
SECOND STAGE
FIRST STAGE
CENTRIFUGAL
CONTACTOR
MIXER BOX
CAUSTIC DOSING PUMP
ACID RECIRC. PUMP
ACID TREATED P.D. TO CAUSTIC TREATER
ROTAMETER
SLOW CONTROL
LEGEND

out shutting down the centrifuge for cleaning purposes.

The products from the centrifuges flow by gravity to a vertical centrifugal pump. Owing to the gaseous nature of the products, it was necessary to pay particular attention to the design of these pumps in order to eliminate vapor binding. To overcome this possibility, the impeller is located at the bottom of a vertical vented drum which permits ready egress of vapors to a common vent line. The throat and impeller design permits low entrance velocities and negligible pressure drop. Delicately balanced liquid level controls on the two interstage distillation pumps maintain a minimum variation in level. Since there is no delay or accumulation in the system, a continuous and uniform flow, which is essential to efficient treating, is assured.

From the final stage, the distillate is pumped to an orifice mixing column through which caustic soda is circulated to neutralize the residual acidity. An intermediate water washing process may be included if the free mineral acid (largely dissolved sulfur dioxide) is sufficiently high to warrant this additional expense.

Two flow controllers are used, one regulates the distillate flow and the other the fresh acid feed. This type of control on acid feed has worked very satisfactorily. The acid feed rate, which is checked hourly in a small blow-case, does not vary so far as the eye can detect. Another proof of the uniformity of acid injection is the constancy of the temperature of the distillate leaving the strong acid contactor.

A second cooler is used to cool the distillate leaving the second stage prior to treatment with fresh acid because considerable temperature rise is experienced in the two acid sludge treatments. This second cooler delivers distillate to the final stage at 70-75° F. and ordinarily leaves the treating plant at about 90° F. The amount of cooling economically justified will have to be determined for each individual treating problem by balancing cost against the increase yield and improvement in quality of treated product.

Some representative data obtained in the operation of the installation described are given in the following table:

Acid Used, lb./bbl.	13.6
Acidity of Acid, percent H_2SO_4	98.3
Raw Pressure Distillate	
End Point, °F.	487
Sulfur, percent	0.435
Percent 420 E.P. Gasoline	88.9
Treated Pressure Distillate	
Percent 420 E.P. Gasoline	85.75
Polymerization loss, percent	3.55
Sulfur in E.P. Gasoline, percent	0.100
SO_2 evolved, lb./bbl.	0.05
Color Bottoms, N.P.A.*	4½
Overall Treating Loss (Tank gauges) percent	6.0
Sulfur in E.P. Gasoline Lab. Treats. percent	0.135

*From rerun unit cutting to 405 E.P.

From an economic standpoint the merits of the Stratford Process have a greater appeal in the desulfurization of distillates that require a moderate or larger amount of acid to produce a satisfactory specification gasoline or where distillates containing a high percentage of unsaturates such as vapor phase distillates cannot be treated by the ordinary method. The principal sources of return from this process are derived from the increased yields of gasoline and distillates, conservation of octane, decreased corrosion to rerunning equipment and better quality of fuel oil. Additional incidental advantages to be obtained are a sludge free of coking material that is readily separable and elimination of settling tanks so that the entire treating unit occupies only a fraction of the space required for a continuous treating system.

Alco Products Incorporated has at its experimental laboratory at Dunkirk, New York, a complete three-stage acid treating unit where samples of distillate are investigated to determine the effects of the many variables that enter into acid treating operations. In this miniature plant many of the control factors, such as strength of acid, temperature, time of contact, effect of previous fractionation or effect of maximum oil temperature in the rerunning operation, can be determined.

This article has dealt largely with the treatment of pressure distillate, although this by no means excludes other types of petroleum products. In fact, the only prerequisite for the application of the multi-stage treating plant is that the sludge be sufficiently fluid so that it can be pumped throughout the system.

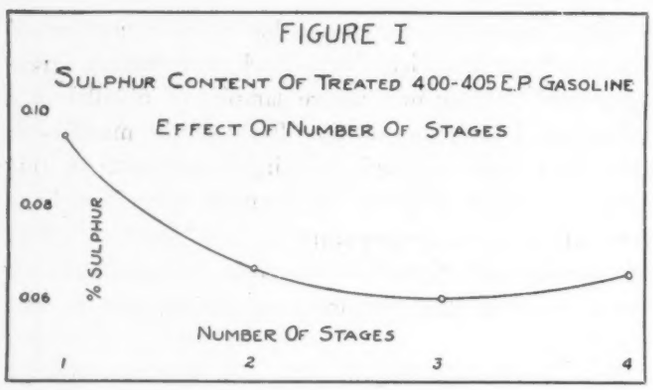
EXPERIMENTAL C. W. STRATFORD ACID TREATING EQUIPMENT

When the Stratford Acid Process was first used the experimental work was carried on at a refinery where 1000 barrels per day of high sulfur distillate was treated. After the successful application of the process on this scale was demonstrated, a 5000-barrel plant was completed. It then became necessary to construct a model treating plant of reasonable size. This was done at Dunkirk and the small plant has proved to be invaluable in predicting yields, quality of treated distillate and in ascertaining other important data from unknown samples of distillates. In order to arrive at some definite conclusion as to the exactness of results attained in this pilot plant when compared with commercial operation, distillate was shipped from the commercial plant for use in the pilot plant. A series of runs soon revealed that the small pilot plant duplicates results obtained in commercial operation in almost every particular. Samples of the raw distillate charged to the commercial plant as well as treated distillate were examined and compared with the treated distillate from the pilot plant. The following data on a raw distillate

and on the treated distillate from the commercial plant follow:

	Experimental Plant	Commercial Plant
Lbs. 98 percent acid/bbl.	13	13
Sulfur in distillate 0.327 percent		
Sulfur in E.P. Gasoline, percent....	0.073	0.09
Treating Loss, percent	3.4	3.3
Polymer Loss, percent	3.7	3.8
Octane (Motor method)	66.7	66.0

These results indicate very strongly that the pilot plant is a tool which can be used with safety in evaluating or predicting results when the Stratford acid system is used.



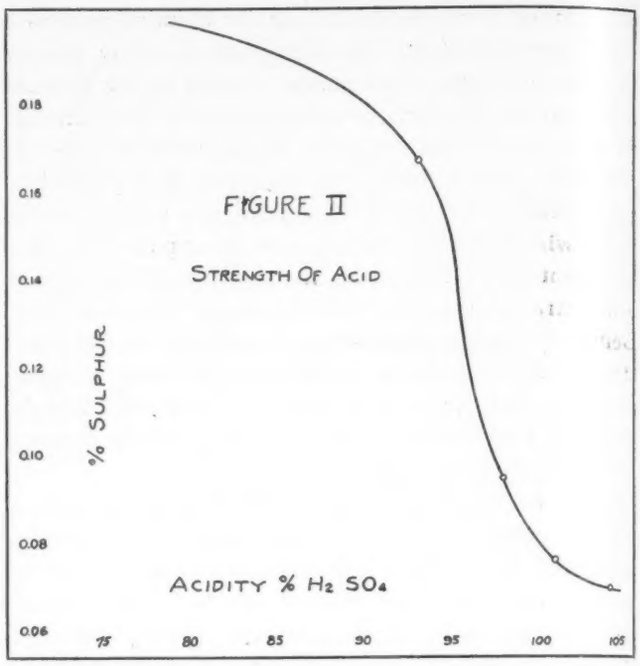
DETERMINATION OF EFFECT OF NUMBER OF STAGES

It is often necessary to demonstrate why three stages of treating are economic and desirable. As an example, the question is frequently asked "why is three-stage treating better than two- or even one-stage treating?" In order to explain this it has been found expedient to set up the experimental plant in a flexible manner so that one, two or three stages can be used. Data obtained proves conclusively that maximum desulfurization of a distillate is obtained when the sludge acid is used twice on the distillate before the strong acid is applied. The accompanying graphs indicate the effect of the several stages. Plant operation has been checked in one instance and corresponds well with the laboratory data.

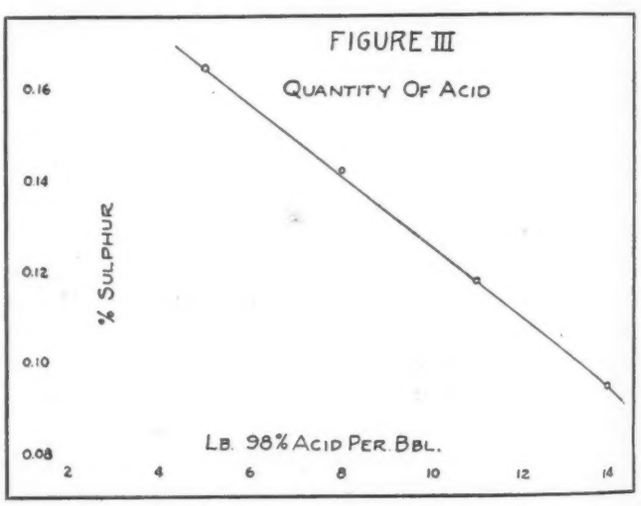
It will be noted that the amount of desulfurization increased with the number of stages up to three, after which an additional stage does not effect additional desulfurization. In fact, the data show a slight increase but this may be due to an analytical error. (Graph No. 1.)

STRENGTH OF ACID AND ITS EFFECT IN DESULFURIZATION

Graph No. 2 indicates that there is a marked increase in efficiency in desulfurization between 95 percent and 100 percent sulfuric acid above which there is a tendency to level out. Less than 95 percent acid is relatively ineffective for desulfurizing purposes.



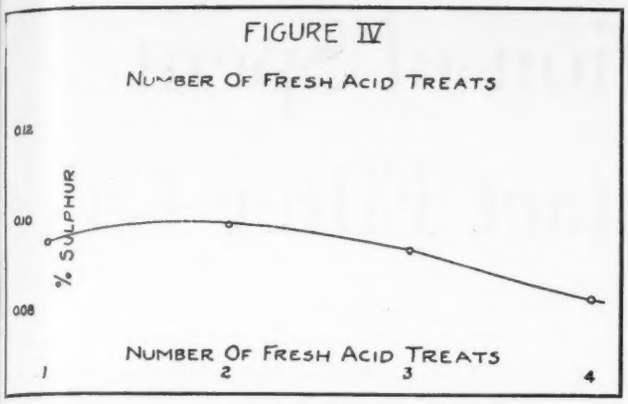
Graph No. 3 indicates that desulfurization is directly proportional to the amount of acid used. This is logical and is in line with past experience.



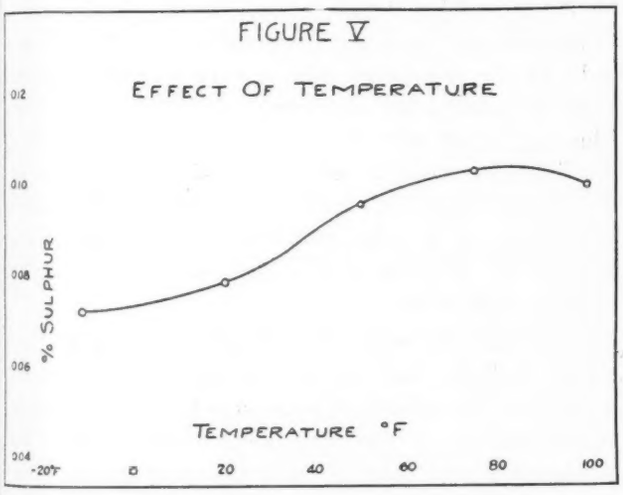
FRACTIONAL TREATING

There has been a noticeable difference of opinion among oil technologists as to the merits of adding acid to oil to be treated in portions. In order to ascertain the advantages, if any, a series of treats were made, where the injections of acid were made in more than one portion. Graph No. 4 indicates that, aside from the so-called "dehydrating" effect of the first acid addition, there is a slight increase in desulfurization when the total acid to be used is added in multiple dumps. The gain is small and does not account for the increased sulfur removal obtained when three stages are used in the Stratford system, employing two stages of sludge acid treating and one of fresh acid.

The effect of treating with acid for desulfurizing at different temperatures was studied and it was found



that there is apparently an increased desulfurizing effect with rising temperature but this appears to reach an economic maximum at 70-80°F. The reason for this is to be found, it is believed, in the side reactions which are accelerated at a faster rate than is the desulfurizing effect. (Graph No. 5.) Accordingly, cooling between stages in the Stratford system is practiced in some cases, especially in warm climates where the distillate reaches a temperature of 90-110°F. in storage or process tanks.



ADVANTAGES OF MULTISTAGE COUNTER TREATMENT

Additional data have been obtained from the experimental Stratford treating plant which indicate that it is possible to obtain the same degree of desulfurization in the three-stage system employing five pounds of 98 percent sulfuric acid as is obtained in a single treat with 10 pounds of 98 percent acid. Another series of runs was made in which a high sulfur distillate was used which required 10 pounds of 98 percent acid to reduce the sulfur content to less than one tenth of one percent. The same distillate was treated with 15 pounds of 98 percent acid in one stage and the same sulfur reduction was accomplished but the distillate showed 1.5 octane points lower in rating than the three-stage treated material. This comparison is most striking and is representative of the advantages of multistage treating.

COMBINATION SYSTEMS

The possibilities of combining clay treating processes with each other and with acid treating are very attractive. The utilization of the Gray vapor phase process for treating a low end point pressure distillate, containing less than the customary limit of one tenth of one percent sulfur can be nicely combined with the Stratford acid desulfurizing process working on either a naphtha side stream withdrawn from the main cracking still fractionating tower or a heavy gasoline stream. In this manner all the advantages of the Gray process are obtained and the acid treating will desulfurize the higher boiling material such as naphtha, and after rerunning the two products can be blended to meet the sulfur and other specifications. The same kind of a combination is also possible with the Osterstrom Liquid-Phase Clay Process and the Gray Vapor-Phase Process. As an example, the Osterstrom process will treat a vapor-phase distillate very efficiently and at low cost to a color of 20-22 Saybolt. If it is desired to produce 25+ color, it will be found expedient to install a Gray tower on the vapor line of the Osterstrom fractionating tower. In this way the advantages of both processes are made use of in the installation.

The combination of the Osterstrom Liquid-Phase Clay Process and the Stratford Acid Desulfurizing Process is ideal for high sulfur vapor-phase distillates. The usual combination consists of cutting the vapor-phase distillate into a light and heavy stream either through partial condensers or by an overhead and a side stream in liquid phase, and condensing the light stream for charging stock to the Osterstrom system and acid treating the heavy stream, high in sulfur, by the Stratford Acid Process. The rerun and treated stream is combined with the clay processed light stream with the result that an acceptable sulfur content gasoline is obtained.

LICENSING OF PROCESSES

The three clay treating processes described are being licensed by Gray Processes Corporation through its sales agents, Alco Products Incorporated, New York and M. W. Kellogg Company of New York. The C. W. Stratford Contact-Centrifuge Acid Process may be licensed through Alco Products Incorporated.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation for the data on the Gray and R. K. Stratford Clay Processes to Dr. M. R. Mandelbaum of the Gray Processes Corporation. Particular thanks are due to Mr. Walter Miller for permission to publish data and photographs of the C. W. Stratford treating plant, also to Mr. C. R. Wagner of The Pure Oil Company for photographs and data on the Osterstrom Liquid Phase Clay Process. The authors are indebted to the World Petroleum Congress for certain data on the Gray Vapor Phase Process published in proceedings of the congress.

Solvent Reactivation of Spent Contact Filter Cake

L. C. TRESCOTT

PART II

A THOROUGH analysis of the problem of reactivation of spent contact filter cake is presented in the accompanying discussion, which is the second and concluding article on this subject. Types of equipment necessary in the design of such a plant are discussed. Cost figures on various methods are given and the value of recovered oils and tars as well as the clay is cited.

IN putting solvent reactivation processes on a plant scale, as with other solvent extraction processes, the plant is built around the extractor. Such processes are not uncommon and there are many of the sort, designed for the production of edible oils, food stuffs, dyes, etc.

In nearly every case these extractors are built with a basket or container into which the material to be processed is loaded in the form of a rather coarsely ground meal or chippings. In some cases the solvent is circulated through this meal. In others it is placed in a chamber which is rotated or is otherwise provided with agitation. After a period of contact the meal is allowed to settle, the rich solvent pumped off to a still, fresh solvent pumped on and the cycle repeated. This goes on until the extraction is complete. The extracted material is taken out of the still while the material remaining in the basket is steamed dry or blown dry with air.

Most of the existing systems were built to operate on relatively coarse material. If the basket be of the circulating type the meal is ground so that it will be sufficiently open for the solvent to penetrate and reach all parts of the charge. If it be of the rotating, agitated type, the meal is coarse enough to settle readily and leave a reasonably clear solution. With the fine clay cakes there is little opportunity for penetration or for a clear settling, even after a long period. The excess of fine slimes quickly plugs the filters of the system.

It was also found that batch treatment was not a successful proposition for this fine material. While by putting on and taking off the solvent at regular intervals a given quantity of solvent can be made to carry more coloring material, it was found that reactivation can be greatly speeded by keeping a flow of the solvent passing through the extractor basket, and that it was necessary to keep the batch thoroughly agitated. With this in view the laboratory apparatus shown in Figure 2 was set up.

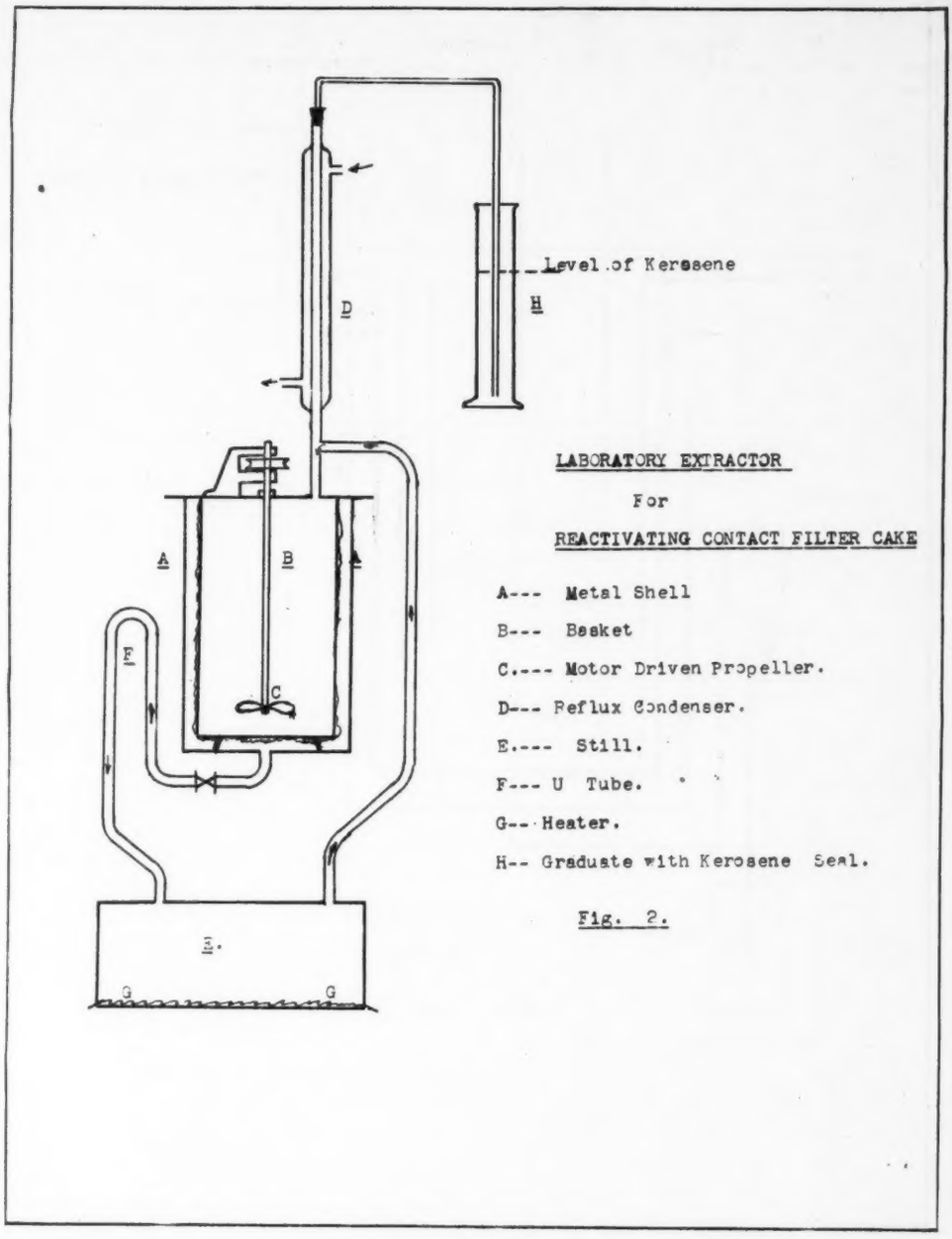
A is a metal shell with a flanged rim at the top, and proxided with a tight removable cover.

B is the extractor basket into which the clay is charged. In this model it rests on small feet about three fourths of an inch off the bottom of the shell and fits up tight against the top when it is fastened down. Its base is a form made from quarter-inch square mesh chicken wire. This is a cylinder of the length shown above and a diameter about 1½ inches less than the diameter of the outside shell. This wire support is first covered with a layer of coarse burlap, then a tight bag of cotton twill filter cloth is pulled up over it all. In charging and discharging the top is taken off and the basket lifted out.

The still may be of any type suitable to the solvents used. In the laboratory type it may conveniently and safely be heated by electricity. A sufficiently large reflux condenser should be hung above the extractor. The line connecting it with the still should be large. The top is connected with a tube which dips under the surface of a large graduate of kerosene, which provides an effective seal, a pressure equalizer, and recovery apparatus.

To operate, the basket is charged with a mixture of solvent and the clay to be reactivated. A sufficient quantity of the solvent mixture is put into the still and the heat turned on. The agitator runs continuously. The condensed vapors from the still flow into the extractor basket through the line 3. The rich solvent carrying the extracted matter from the clay flows through the filter cloth into the space between the basket and the shell. It rises in this space until it reaches the top of the U tube in the line 1. In the laboratory set up this tube is made from glass and furnishes a convenient sight glass to judge the progress of the extraction. Line 1 should be provided with a stop-cock for controlling the flow. Once started the operation automatically takes care of itself. The color of the stream from the extractor to the still shows when the extraction is complete, but this must not be taken as an indication that the reactivation is finished. It will generally be found best to run the extractor on a time basis, and small samples may be taken from the basket and tested by a run on a standard grade of oil.

This is in effect a Soxhlet type of extractor, and for small samples the large glass Soxhlet extractors may



LABORATORY EXTRACTOR

For

REACTIVATING CONTACT FILTER CAKE

A--- Metal Shell

B--- Basket

C.--- Motor Driven Propeller.

D--- Reflux Condenser.

E.--- Still.

F--- U Tube.

G--- Heater.

H-- Graduate with Kerosene Seal.

Fig. 2.

be used, but they are not very satisfactory. The solvent does not penetrate the mass of clay in the thimble very readily and the reactivation is slow. They should be run at least 36 hours and even then it is better to check the results with an extractor which is provided with an agitator.

Toward the end of the reactivation, tests may show that treatment to correct the pH value may be necessary. The acid salts may be added during the last stages of the process.

To dry the batch it may be spread out on paper towels and air-dried.

In the laboratory the single extractor with its own still is a very satisfactory unit. In the plant it is necessary to have a number of extractors so inter-connected that some sort of counter-flow of solvent will be possible and in which the flow of extract from all extractors goes to a single still. At least the clean oil extract goes to one still and that carrying the tarry coloring matter to another. The system must be tied in with a dryer for finishing the clay, and the outfit as a whole must be vapor-tight, preferably with a single opening for charging all extractors, and a single opening for discharging the clay, neither of which will offer much opportunity for the escape of vapors. Further, the whole outfit should be vented through a suitable and compact vapor recovery system.

The large scale extractor is essentially the same as the laboratory type. This is shown in Figure 3.

The outer shell *A*, flanged at the top, gives about two inches clearance all around to the extractor basket. This basket *B* is welded into the wide flange *I* which rests on the flange on the top of the shell *A*. It rises about a foot above the wide flange and is provided with a removable cover.

From its top to a point about six inches below the

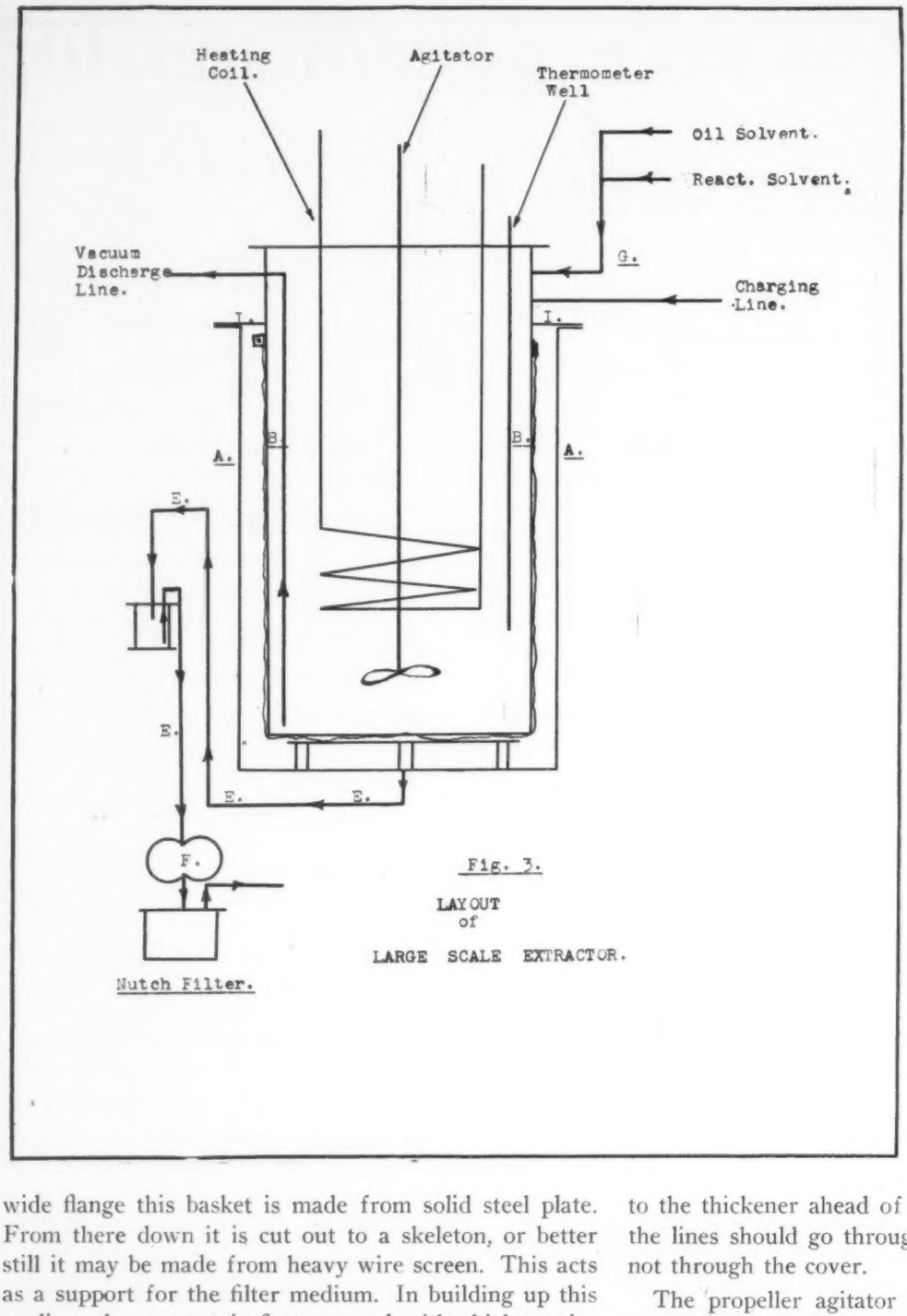


Fig. 3.

LAYOUT
of
LARGE SCALE EXTRACTOR.

wide flange this basket is made from solid steel plate. From there down it is cut out to a skeleton, or better still it may be made from heavy wire screen. This acts as a support for the filter medium. In building up this medium the support is first covered with chicken wire of half- or quarter-inch square mesh. Over this is sewn the burlap support for the filter cloth. The filter cloth is sewn into a tight bag and pulled up over the burlap. It extends up over the screen to the solid plate and is secured by a flat metal strip which clamps around the basket. Outside, another layer of chicken wire is put on to keep it from bulging. Underneath is a loose support which presses up against the bottom of the basket and keeps it from bulging down.

The top of the basket is provided with an inlet line *G* for fresh solvent, a thermometer well, a charging line through which the cake-naphtha slurry is pumped into the basket, and a suction line extending to the bottom of the basket through which the finished batch is drawn to the thickener ahead of the dryer. So far as possible the lines should go through the side of the basket and not through the cover.

The propeller agitator is driven through some sort of standard bevel gear agitator drive which is bolted to the cover. It is well to have this belt driven and provided with a shifter for cutting the extractor in and out of service.

The inlet and outlet for a small steam coil for heating the extractor, also go through the cover.

The outlet for rich solvent goes out at the bottom. The piping is carried up through the U tube *E*. It is drawn through the sight glass in the line *E* by the pump *F*. This pump discharges through the small Nutch or leaf filter which is provided to keep sediment out of the still in the case of leaks or breaks in the filter cloth.

In Figure 4, a layout of a three extractor plant is shown. A list of its items follows:

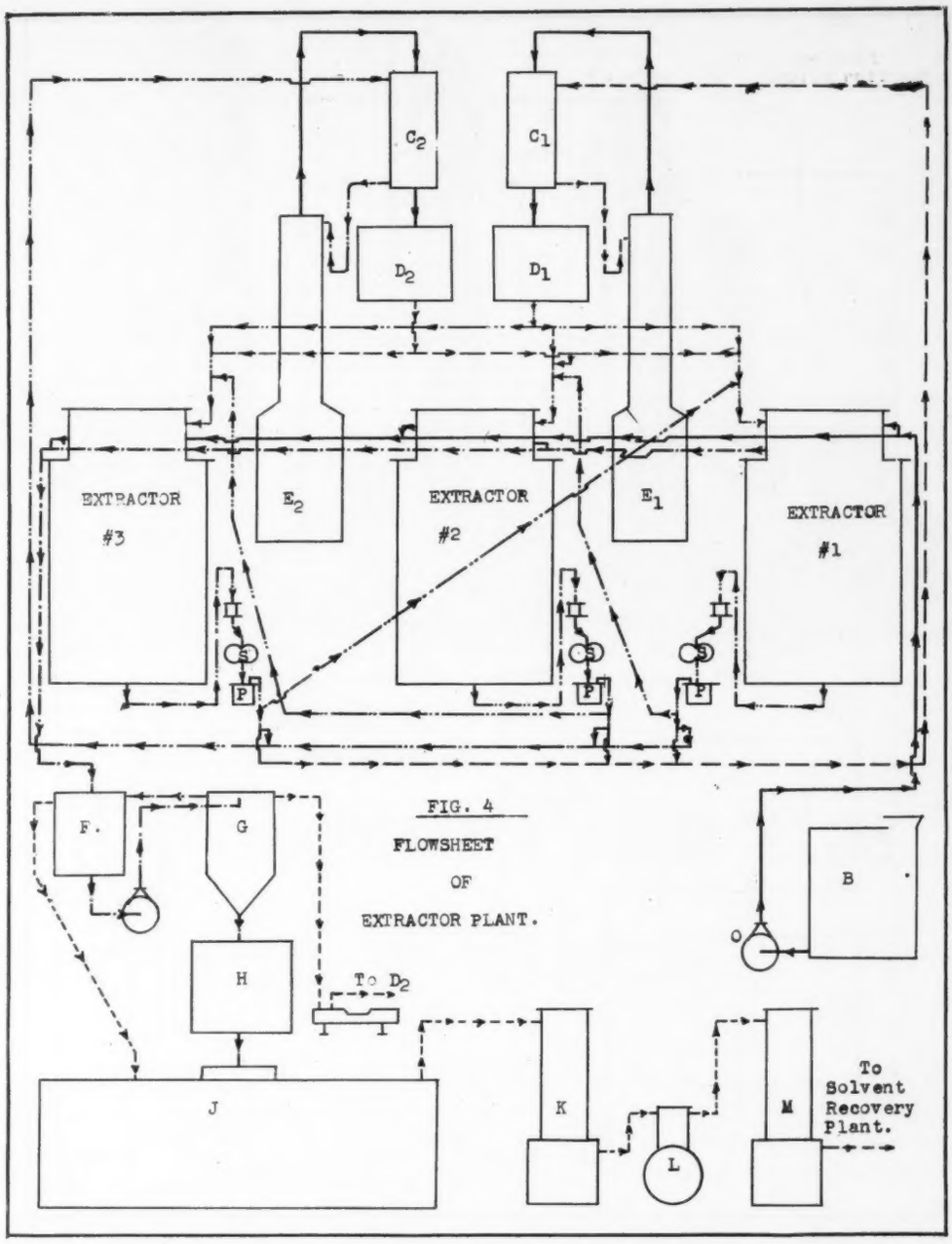


FIG. 4
FLOWSHEET
OF
EXTRACTOR PLANT.

Extractors—A. The extractors have already been described. This particular type has been patented.

Charging tank—B. This is the point where the cake to be reactivated enters the system. It is a straight sided tank, slightly larger than an extractor basket, and its cover is provided with a hopper through which the cake is dumped. This hopper must have a gas-tight cover. It has an agitator and drive exactly the same as is used on the extractors.

Charging pump—O. This is a centrifugal pump of a suitable size. The vertical discharge type is to be preferred owing to the absence of trapping. The cake-naphtha slurry is easily pumped.

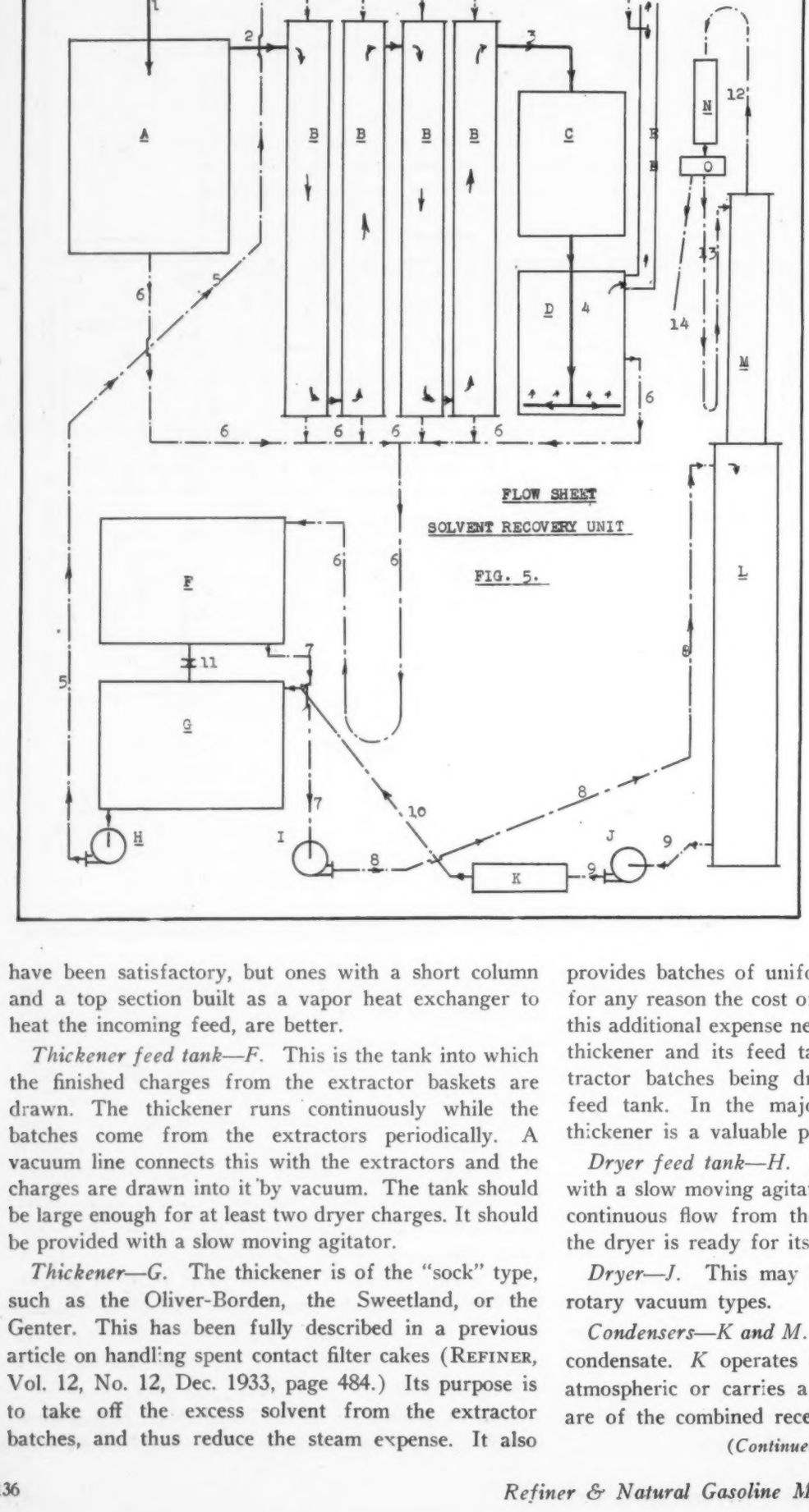
Condensers—C_1 C_2. Any condenser suitable for the solvent is satisfactory here. Care should be taken to have plenty of condensing surface.

Receivers—D_1 and D_2. These are the tanks which take the condensate from the condensers C_1 and C_2 from which the flow of fresh solvent is drawn to the extractors. These as well as all other tanks which carry solvent should be vented through the solvent recovery system. The receivers should be provided with gauge glasses.

Extract pumps—S. Small gear pumps have been found satisfactory for this place. There is some wear on the pumps as the extract carries a small amount of fines which is later taken out by the Nutch filters. Steel shafts will be found more satisfactory than the brass shafts which are sometimes supplied.

Nutch Filters—P. These are small filters of a plate and frame type, totally inclosed, or perhaps of a home-made pressure leaf type. The leaves are built up on pipe frames and covered with cotton twill filter cloth on a burlap support.

Stills—E_1 and E_2. Steam heated stills of any type suitable to the solvent may be used. Simple shell stills



have been satisfactory, but ones with a short column and a top section built as a vapor heat exchanger to heat the incoming feed, are better.

Thickener feed tank—F. This is the tank into which the finished charges from the extractor baskets are drawn. The thickener runs continuously while the batches come from the extractors periodically. A vacuum line connects this with the extractors and the charges are drawn into it by vacuum. The tank should be large enough for at least two dryer charges. It should be provided with a slow moving agitator.

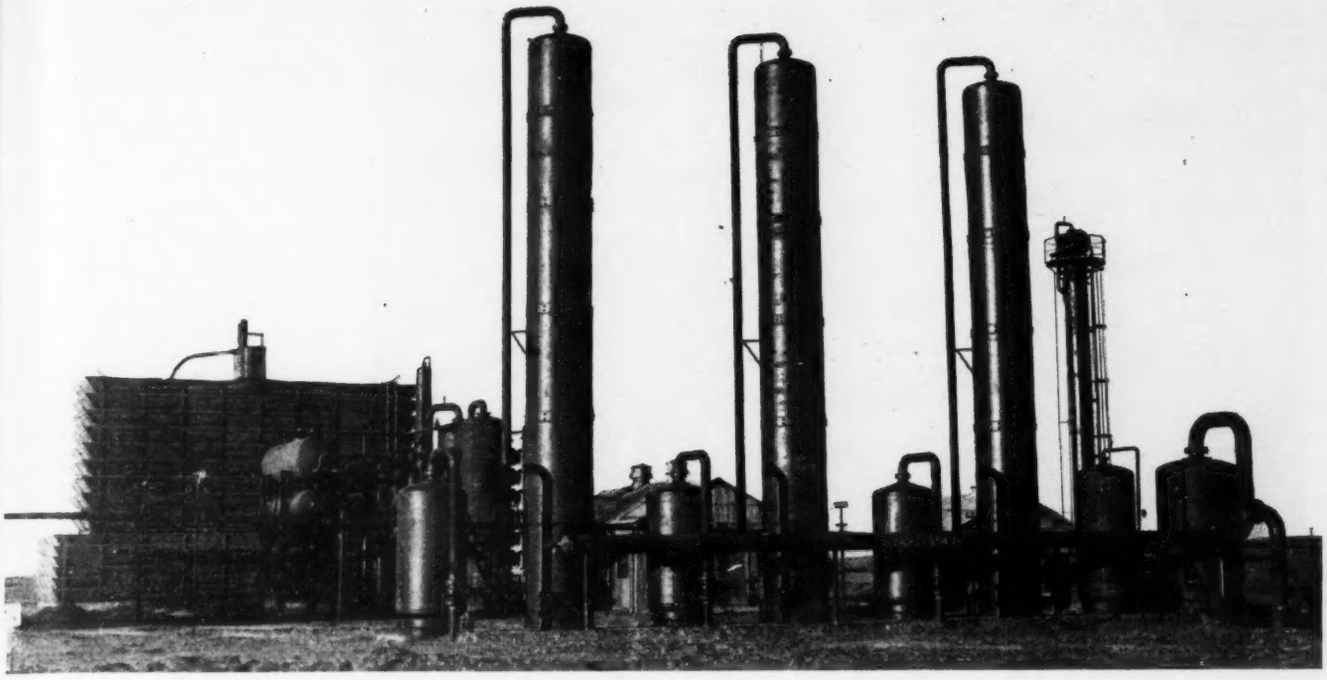
Thickener—G. The thickener is of the "sock" type, such as the Oliver-Borden, the Sweetland, or the Genter. This has been fully described in a previous article on handling spent contact filter cakes (REFINER, Vol. 12, No. 12, Dec. 1933, page 484.) Its purpose is to take off the excess solvent from the extractor batches, and thus reduce the steam expense. It also provides batches of uniform quality for the dryer. If for any reason the cost of heating steam be so low that this additional expense need not be considered, then the thickener and its feed tank may be left out, the extractor batches being drawn directly into the dryer feed tank. In the majority of cases, however, the thickener is a valuable piece of equipment.

Dryer feed tank—H. This is a tight tank provided with a slow moving agitator. Its purpose is to take the continuous flow from the thickener and hold it until the dryer is ready for its charge.

Dryer—J. This may be any of the steam heated, rotary vacuum types.

Condensers—K and M. These take care of the dryer condensate. *K* operates under a vacuum while *M* is atmospheric or carries a slight pressure. Unless they are of the combined receiver types they must be pro-

(*Continued on page* 149)



Smith Brothers Refining Company gasoline plant at McLean, Wheeler County, Texas. Gas lift gas-and-water separator shown at top of cooling tower.

New Well Pressure Plant Has Interesting Features

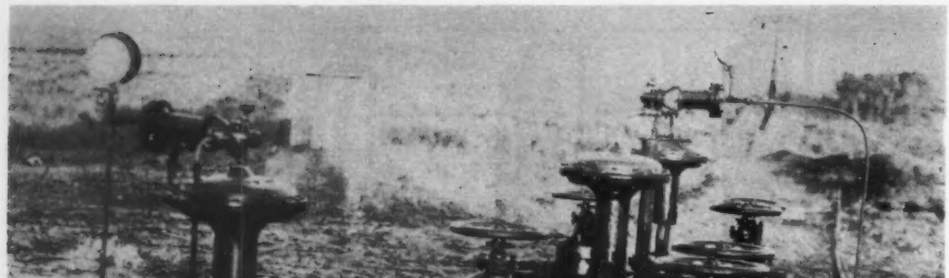
SMITH Brothers Refining Company, in February of this year, began operating its well pressure gasoline extraction plant, northeast of McLean, Texas, in Section 33, Block 34, H.&G.N. Survey, Wheeler County. The plant takes gas directly from the wells surrounding it, reducing it from field pressure to 250 pounds as it enters the plant.

Designed and constructed to operate under pressures as high as 350 pounds in the extraction part of the unit, the absorbers were built of three quarter-inch steel plate, welded throughout, and in addition they were fabricated with riveted reinforcing rings surrounding the seams. Three of these are installed, five feet in diameter by 44 feet in height and containing 16 trays each. They are capable of processing 30,000,000 cubic feet under a pressure of 250 pounds. They have double mist extractors in the upper section to prevent entrained mineral seal oil from passing out with the stripped gas before it enters the residue scrubbers on the concrete base beside each tower.

Gas enters the plant through a 16-inch line upon which is set a master meter, and from this setting, it is cleaned of foreign matter and field line drip in a single scrubber, entering through a tangentially welded flanged fitting. This scrubber is seven feet in diameter by 10 feet in height and fitted with a single mist extractor to prevent contamination of the absorption oil by crude from the wells. Leaving through the upper head through flanged and welded fittings, the gas is carried through a common header placed upon stanchions, to the entrance of the absorption columns. In winter the temperature of the gas entering the absorbers runs around 56° F. and will continue to remain rather low because of the expansion at the wells. Pressure is carried at 240 pounds on the residue outlet and is maintained at this pressure by pilot operated controllers.

Oil to the absorbers is handled by a multiple centrifugal pump setting, driven by a 175 horsepower turbine, especially designed to operate on high pressure gas at a pressure of 190 pounds with 15 pounds back pressure. Two separate pumps in the multiple setting are provided for the oil circuit, the low pressure unit taking suction from the bottom of the lean oil surge tank. It delivers the oil under a temperature of 106° F. to the four oil coolers, set in one end of the cooling tower. These oil sections, as well as the gasoline condensers and dephlegmator water coolers have flanged heads, which are removable by taking out a row of bolts so the tube ends and tube sheet may be easily inspected.

After cooling to an average of 75° F., the oil passes



Regulator setting for holding back pressure on residue, reducing pressure to turbines and reciprocating pumps and to gas lift "well" in cooling tower.

to the intake of the high pressure pump which acts as the second stage, boosting the pressure to 250 pounds to enter the absorbers, and is removed from the base through liquid level controllers. A 110-pound drop is effected through the control valves and a short distance away it enters a high pressure vent tank. This is five feet in diameter by nine feet six inches in height. This separator is fitted with a liquid level controlled gas vent valve, permitting the vapors escaping from the oil to pass through an overhead line, while the oil travels on to the heat exchanger. Dropped in pressure from 110 pounds to 60 pounds, it is passed through 12 sections of the exchanger, counter current to the hot oil from the still, and enters a second vent tank where those vapors liberated from the oil are passed directly to the dephlegmator on a by-pass around the still or evaporator. Travelling on from the second vent tank, the oil passes through the remaining two sections of the exchanger to the preheater, which is 20 inches in diameter and is filled with half-inch iron pipe welded to a tube sheet at each end. This construction is usual with this type plant and since both the tube bundle and shell are made from the same material this prevents stresses from being set up within the unit.

As the oil passes from the preheater, it has been heated to 250° F., at which temperature it enters the still. This unit is maintained at 310° F. and under a process pressure of 55 pounds. Process steam for agitation and partial pressures is admitted through manually controlled valves placed in a harp, or manifold made up containing two two-inch, and two one-inch connections. More readily adjustible to conditions met in operating the unit; it enables the stillman on duty to control the steam input with more accuracy than if one large valve was used.

Stripped oil flows through a liquid level controlled valve directly to the heat exchangers, traveling through all sections in turn before entering the lean oil surge tank to complete the cycle.

Vapors driven from the oil processed in the still pass through an overhead line and downward to enter the base of the dephlegmator, a unit five feet in diameter by 21 feet six inches in height. Rising through the plates, they encounter direct water cooling to effect the proper end point of the gasoline vapors leaving the upper head. Water is circulated from the base of this column by one of the pumps driven by the gas turbine, and cooled through one section of open coolers in the tower. The amount necessary for effective refluxing is controlled by one of the several instruments in the plant. Excess water above that necessary for effective operation is trapped away from the base of the dephlegmator and flows to the feed water heater at the boiler room.

Gasoline vapors at 185° F. leaving the upper section of the dephlegmator are carried through the vapor line to two open type condensing sections in the cooling tower, where the higher boiling fractions are condensed and cooled to 70° F. Passing continuously from these condensers, the gasoline and water vapors condensed enter a 20-inch by eight-foot dewatering tank where separation is effected before the gasoline accumulates in the horizontal run tank. This is five feet by 20 feet with a capacity of 3000 gallons. Water from the base of this separator is dumped to the sewer through a trap, as it has become sour and saturated with hydrogen sulfide, which makes it unsuitable for reuse, either in the boilers or cooling tower basin.

Vapors from the preliminary high pressure vent tank on the absorber outlet together with those coming from the run or accumulator tank are carried to a reabsorber to be contacted the second time with lean mineral seal oil. This column is two feet in diameter by 30 feet in height, and a split stream is diverted from the lean oil circulating pumps to it in proportion to the volume of vapors passing through. Only 25 pounds pressure is maintained on this stripping column to make it possible for all low pressure vapors to be processed without the installation of a recompressor. The oil from the base of this column is pumped to the exchangers, while the dry gas from the overhead lines lead to waste or the residue system.

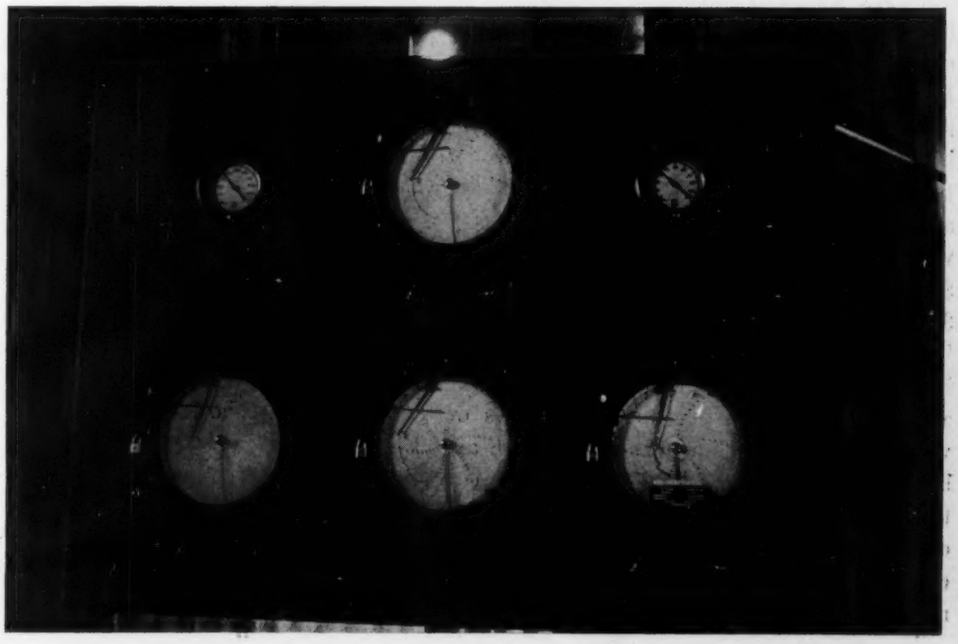
Containing all the fractions carried in the original

gas that might have a possible value, the gasoline is picked up from the base of the accumulator tank by a close clearance reciprocating pump, eight inches by five inches by 12 inches in size, and delivered under a pressure of 175 pounds to the fractionating column. This tower is three feet in diameter by 49 feet in height and carries the regular overhead reflux water cooled condensing section, and also has four inlet connections for the raw feed. Thirty trays are provided, and the feed can be admitted to any of four separate trays, depending upon the tray temperature and the temperature of the feed entering the column. Four gasoline exchangers are placed near the base of the fractionator and the gasoline on its way to the fractionator passes through these units to cool the finished gasoline, and to bring up the temperature of the feed stock. The column is operated, when processing to 26/70 gasoline, at 175 pounds, an overhead temperature of 160° F. and a bottom, or reboiler temperature of 265° F. The reboiler is a horizontal shell, three feet in diameter by 20 feet in length, containing a heating element through which live steam is passed to maintain the proper processing temperature. Exhaust steam is sometimes used in other plants, but the absence of steam driven pumps in this system prevents anything but live steam being used. Passing back through the gasoline exchangers and coolers the stabilized product is placed in storage. Five tanks were set for this purpose, each holding 24,000 gallons. The product being sour and corrosive, it is necessary to treat with doctor solution, or lead sulfide before shipment.

Boiler capacity is only necessary to generate steam for processing purposes, that used in pre-heating the oil and reboiler at the stabilizer, and for heating control rooms in the plant. High pressure gas at 190 pounds is used to drive all pumps, both centrifugal and reciprocating. It is used cold, lubrication having been worked out so that low temperatures from expansion can be encountered without any ill effects in the turbine case or the pressure cylinders of the reciprocating pumps.

No circulating water pumps are used in this plant excepting those pumping water over the dephlegmator control plates and through the condenser section of the stabilizer. Water is circulated over the cooling tower through the operation of gas jets. A "well," 20 inches in diameter, was drilled to about 40 feet, cased and cemented at the bottom to form a deep narrow sump. High pressure gas is led to a jet system to lift the water from this sump in exactly the same way that water is lifted from original water wells. The upper end of the casing is flush with the floor of the water tower basin, and the water runs into the "well" as fast as it is taken out. As the water is lifted to the top of the tower, it enters a water and gas separator, the water flowing from the base to the distributing troughs and the gas, taken from the upper head is led to a waste vent some distance from the plant. This arrangement not only saves on power bills, but as long as the plant operates at a pressure high enough to furnish gas for the gas lift in the "well," water can be circulated as rapidly and with as much volume as needed. This lifting apparatus is capable of lifting and spraying through the decks of the tower as much as 2000 gallons of water per minute.

This plant is capable of processing in excess of 100,000,000 cubic feet of gas each day, and with a gasoline content of .30 to .35 gallons per thousand, the daily production would be around 32,000 gallons of 26/70 gasoline, but with the operation of the plant, an efficiency of 135 is obtained, giving the plant a factor of 1.35 and a gallonage of 43,200 gallons of finished product each day. Sufficient gas is available to justify enlargement of the plant, which may or may not be done, depending upon the outcome of the regulation controversy concerning utilization of gas in the Panhandle. Changing market conditions necessarily change the operating conditions of the stabilizer only, and when making gasoline with 14 pounds vapor pressure, approximately 35 percent less gasoline is pumped to the rack than when making standard 26/70 product.



Instrument board bracketed to wall of control room.

White Hydrocarbon Oils and Their Production

A. L. NUGEY
Consulting Engineer, Rahway, N. J.

WHITE hydrocarbon oils are recovered from the distillation of crude oils. The three important sources from which the crude oils are derived are America, Russia and Scotland. The American and Russian crudes contain larger percentages of paraffins than olefines, while those derived from Scottish shale are usually vice versa. In producing white hydrocarbon oils, there are available numerous simple, as well as complex refining processes. Process details naturally, will vary with the nature of the crude, however, the general principles of all processes are the same.

This article is intended to suggest to refiners of the possibility of converting some of their present low priced hydrocarbon oils into high priced white hydrocarbon oils. It is not natural to expect the performance of miracles, or for gold deposits to be found at the foot of the rainbow, if white hydrocarbon oils are produced, but inasmuch as the refiners are all in the business for profit, the production of white hydrocarbon oils may be of benefit.

A great deal has been said about the unsurpassed qualities of Russian white hydrocarbon oils; oils par excellence for medicinal and cosmetic purposes. There is not even the faintest excuse that can be offered why domestic white hydrocarbon oils can not be made equal in quality to the imported white oils. These white oils may be classified as "technical" and "medicinal" grades. During 1931 the scant statistics made available indicate that 3,530,000 pounds of white medicinal oils had been imported into this country and it is well to point out that this was considered a depression year. For an average specific gravity of 0.87, these 3,530,000 pounds would be equivalent to 490,000 gallons. At a rate of $1.00 per gallon, this represents a monetary value of $490,000. This figure does not include the white "technical" grade oils, of which large quantities were imported or those that were produced in this country by a few of the major refiners. Records of imports as well as domestic production figures are an outstanding barometer which shows actual economic conditions, and this data can only be obtained through government channels. Accurate, reliable and full statistical data are essential to the orderly conduct of any business. In many instances such data as might be supplied for dissemination is deliberately designed to mislead. In all probabilities, due to the lack of full statistical data, this might be the most potent factor that has been curtailing the development of the white hydrocarbon oil production in this country. It certainly cannot be attributed to the better quality of Russian crudes.

WHITE HYDROCARBON OILS

It has already been stated that white hydrocarbon oils are classed as "Medicinal U. S. P." and "Technical" grades. The medicinal oils are subdivided into U. S. P. Heavy and U. S. P. Light. The average typical specifications for these oils are given below:

For U. S. P. Heavy Grades
Specific Gravity, from 0.900 to 0.880
Saybolt Vis. at 100° F., from 335/345 to 175/185
Cloud Point, minus 10° F.
Pour Point, minus 20° F.

For U. S. P. Light Grades
Specific Gravity, from 0.875 to 0.850
Saybolt Vis. at 100° F., from 125/135 to 80/90
Cloud Point, minus 15° F.
Pour Point, minus 25° F.

For both of the above grades, the sulphuric acid test must be perfect; mixed acid test must likewise be perfect, while the lead oxide test must be negative.

Medicinal oils must be absolutely free from odor, taste and fluorescence. They must be crystal clear in color. These oils are used for emulsions, such as Petrolagar, Agarol, Kondremul, Cream of Agar, for general constipation purposes, nose and throat sprays, and for certain high grade cosmetics and creams. This explains why these oils must be of the highest purity as demanded by the United States Pharmacopoeia.

TECHNICAL WHITE OILS

These oils are used in the manufacture of quality facial creams, cosmetics and hair brilliantines. They, too, must be crystal clear in color and free from odor and taste. They must meet the U. S. P. sulphuric acid test for purity. These grades vary from 75 to 110 seconds Saybolt viscosity. A typical analysis for these oils is shown below:

Specific Gravity, 0.835 to 0.845
Saybolt Vis. at 100° F., 75 to 110
Pour Point, 30° F.
Cloud Point, 40° F.

For the baking and the confectionary industries, oils having the above specifications are ideally suited. In

the former, the oils are used for the dough dividing machines, while in the latter the oils are used exclusively for slabbing purposes, that is, a thin film of oil is applied to the marble or metal slabs so as to prevent the confection from adhering to the slabs during the course of preparation.

WHITE OILS USED AS LUBRICANTS

These oils are necessary for lubricating in the textile machinery. Being water white and absolutely bloomless, they eliminate to a great degree discolorations on textile fabrics in the event any lubricant is accidentally splashed upon the fabrics in the course of weaving. The specifications of technical white oils used for lubricating textile machinery naturally depend upon such factors as speed of shafting and the bearing pressures. Oils suitable under general conditions will have the following properties:

Specific Gravity, 0.835 to 0.885
Saybolt Vis. at 100° F., 75 to 185

MANUFACTURERS OF WHITE OILS

The pioneer manufacturers of white oils in this country are: Standard Oil Company of New Jersey; Standard Oil Company (Indiana); Standard Oil Company of California, and L. Sonnenborn Sons, Inc. These several pioneer manufacturers of white oils, obviously, have made great strides in perfecting their respective white oil refining processes since their advent into this industry. Every stage of the operation is rigidly supervised and controlled by experienced technologists. There is no other alternative, because of the definite tests set forth in the standards of the United States Pharmacopoeia. Even in shipping the oils these manufacturers carefully select the containers. They must be scrupulously clean, inasmuch as slight impurities will impair the entire contents of the container. The magnitude of the cost due to damage can easily be calculated, particularly on drum shipments, which have a volume of 54 gallons. The practice of one particular firm is to thoroughly rinse the shipping containers with white oil, identical to the grade with which the container is to be later filled.

Exhibit-A.

Prices for domestic grades:	Per. Gal.
865/870 sp. gr. Vis. 125/135	.76½
875/885 sp. gr. Vis. 175/185	.79½
890/900 sp. gr. Vis. 330/350	.87½
Prices for Russian grades:	
860/865 sp. gr. Vis. 75/80	.80
870/875 sp. gr. Vis. 145/155	.93
875/880 sp. gr. Vis. 185/190	.96
880/885 sp. gr. Vis. 285/295	1.01
885/890 sp. gr. Vis. 325/335	1.03

Exhibit-B.

Prices for domestic grades:	Per Gal.
865/870 sp. gr. Vis. 125/135	.70½
875/885 sp. gr. Vis. 175/185	.78
890/900 sp. gr. Vis. 330/350	.83
Prices for Russian Grades:	
860/865 sp. gr. Vis. 75/80	.58
870/875 sp. gr. Vis. 145/150	.73
875/880 sp. gr. Vis. 185/190	.76
880/885 sp. gr. Vis. 285/295	.78
885/890 sp. gr. Vis. 325/335	.80

sp. gr. denotes specific gravity.
Vis.: this is based on 100° F. Saybolt.
All prices are per gallon, based on drum lots.

MARKET PRICES

The present market prices for white hydrocarbon oils as quoted by the Oil, Paint & Drug Reporter of New York City, is shown in Exhibit-A. The Exhibit-B shows the prices that prevailed, approximately six months ago. An examination of these exhibits shows a decided improvement in the corresponding grades of white hydrocarbon oils over a very short period. There is no doubt but that the prices will rise higher, because the demand for these oils continues to be firmer each day. In 1928, the price for the 0.885 and 0.890 specific gravity oil, with a viscosity of 325 to 330 at 100° F., was $1.25 per gallon, in drum lots.

MANUFACTURING PROCESSES

Many patents have been granted on the production of white hydrocarbon oils. Of those granted the major proportion are impractical and cannot be applied commercially. In the first instance, patent allowances have been granted upon claims derived from laboratory experiments and have not been reduced to commercial operation. Secondly, those processes that indicate commercial feasibility call for such a large initial capital investment for the processing equipment that the refiner of limited financing is unable to equip a plant. Thirdly, the other prohibitive factor is that the cost to produce the white hydrocarbon oils is too high.

In order to make the proposition interesting the initial capital investment must be moderate and the subsequent cost of production must allow an attractive profit margin to the manufacturer. Bearing these factors in mind, such a process is herewith presented. The cost of the processing equipment will be in reach of any refiner, large or small. Similarly, the profit to be derived, also is important.

SPACE REQUIREMENTS FOR PLANT

The floor space required for a small commercial white oil manufacturing plant will not exceed 4500 square feet. A brick building of one story high will suffice. Many refiners may have available some idle building that would just suit the purpose. Steam, air and cold water should be available. With a building available having the above noted services, naturally the necessity of capital investment for a new building will be eliminated.

The following is a list of equipment that will be required for a small commercially profitable white oil

manufacturing plant. The capacity of this plant is noted elsewhere.

DESCRIPTION

One 8000-gallon steel distillate oil storage tank.

Two 1800-gallon steel, lead lined agitators, for acid-treatment. One agitator to be equipped with steam coil for heating the oil.

One 1800-gallon unlined steel agitator for neutralizing and washing and drying the oil.

Two rectangular wood tanks lined with tin plate to be used as settling tanks.

One heavy steel riveted fuming acid storage tank, complete with a 55-gallon pressure vessel with gauge glass for measuring and feeding correct amounts of acid.

One centrifugal pump and motor for agitating oils.

One small water-cooled tank, for cooling oil during acid treatment.

One centrifugal pump and motor for transporting of the oils about the various equipment.

One 110-gallon capacity rotary fullers earth calcining furnace.

One 700-gallon copper still, complete with vapor pipe condenser and auxiliaries for recovering the alcohol and the sulphonated oils.

One sweetland clay filter.

In addition to the above, there should be available the necessary piping for water, air, steam, and oils, alcohol and acids, also working tools, thermometers, gauges and electric wiring to motors.

RAW MATERIALS

The raw materials that will be required to produce white hydrocarbon oils are given below:

30/60 mesh fullers earth
Finely powdered (mesh 150) fullers earth
Flake caustic soda
Methyl alcohol
20 percent fuming acid
66 Be. sulphuric acid.

DISTILLATE TO BE USED

Experiments have been conducted on a mineral oil distillate of the paraffin series having a viscosity of 420 at 100° F. It was found that this distillate would produce a finished white oil of 250 viscosity at 100° F. The yield was roughly measured as being 50 percent of the actual distillate used.

STEPS OF PROCESS

The process steps may be briefly described as follows:

(1) Two percent by volume of 66 Be. sulphuric acid was added to the distillate in the agitator for precipitating the asphaltic matter.

(2) Fifty percent by volume of the 20 percent fuming acid was next slowly added to the agitator, during subsequent mixing and cooling operations.

(3) The settling of all sludge was next accomplished in the two wood settling tanks.

(4) The next operation consisted of neutralization with a caustic soda solution within the unlined agitator.

(5) The sulphonated oil soaps are then extracted by means of methyl alcohol.

(6) The next operation consists of a thorough washing of oils with clean water.

(7) After blowing the oils free of water with air, they are mixed with the calcined fullers earth, consisting of both the 30/60 mesh and finely powdered so as to build up the proper cake. After filtering through the Sweetland filter, the finished white oil is pumped to storage, finally into drums or bottles.

In the operation of this process, the temperatures during the complete cycle must be maintained at the proper degree, also the period of acid treatment, subsequent agitation, washing, air blowing, all play an important role in this process, and each refiner can easily determine these in operating with their available distillates.

PLANT CAPACITY

On the basis of the above enumerated equipment, it is possible to put through one batch of 1500 gallons of white oil in five days. Since two agitators are recommended, it will be possible to make two batches in five days, and with a 50 percent yield, it will be possible to produce 9000 gallons in 30 days.

Estimated Monthly Earnings:

Gross Income	9,000 gals. at 75 cents per gal...		$6,750
Less Cost Materials			
Distillate, 18,000 gals at 10 cents		$1,800	
Acids		850	
Alcohol		170	
Caustic soda		15	
Fullers earths		150	
Drum investment		500...	$3,485
Sub-Total			$3,265
Less Operating Expenses			
Rent		$ 200	
Steam		25	
Electric power		30	
Water		5	
Labor		95...	355
Trading Revenue			$2,910
Less fixed charges, 15 % $8,000			100
Net Monthly Profit			$2,810

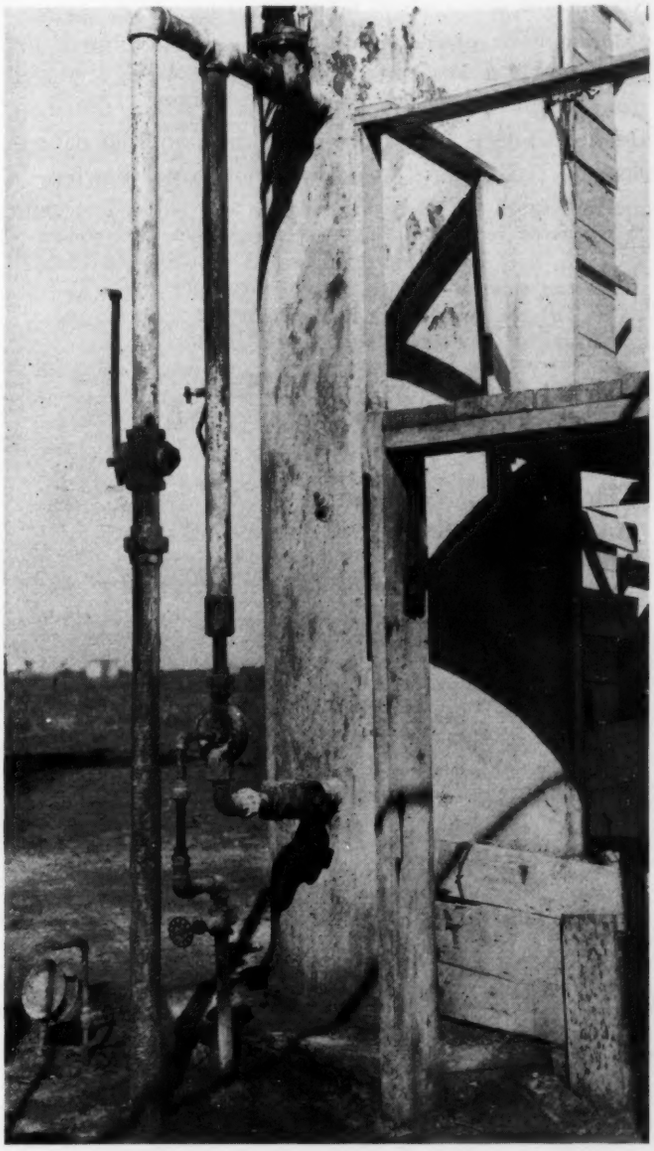
Based upon the above figures, it is possible to make 9000 gallons of white medicinal oil of 335/340 viscosity, which is quoted in Exhibit A as $1.03 per gallon. In estimating the gross income, the price was based on 75 cents per gallon in order to cover any possible unforeseen contingency as to raw material costs, distillate costs, etc. In order to increase the production not much additional equipment will be required. If it is desired to produce a lighter medicinal oil than the 335/340 viscosity, then the yield will be proportionately greater than 50 percent. The total cost of the equipment noted in this article for the production of these white oils did not exceed $8000, and with this investment, the net yearly profit would be $2810 × 12 months = $33,720.

Stabilizer Pressure Circulates Chemical in Treating Column

GASOLINE manufactured by Westoaks Gasoline Company from gas produced in the Sayre field, Beckham County, western Oklahoma, is a trifle sour and slightly corrosive, but when treated with calcium hypochlorite it remains stable to light and is sweet and noncorrosive in storage. The conventional methods of contacting the manufactured product with hypochlorite solution were used for some time—pumping the treating agent with the gasoline through baffles, knothole mixers, etc., but eventually the superintendent of the plant hit upon a plan to contact the treating solution and the gasoline by utilizing the pressure exerted upon the gasoline in the stabilizer to circulate the solution with a jet, using the same solution over and over again until its treating effectiveness becomes impaired.

Production of gasoline in this plant is not large, and the gallonage is in direct proportion to the outlet, or sale, for residue gas. Some of the residue is returned to the field for prospecting and drilling purposes, but the greater amount is burned in a carbon black plant nearby, owned by the same company. When this black plant is not being operated the gasoline plant does not process enough gas to warrant extraction. Consequently, the apparatus installed for treating the stabilized product is not large. More or less conventional in design, it consists of two vertical tanks, 30 inches in diameter by 20 feet in height, one used as a contacting column, or receptacle for the treating solution, and the other for settling and separation of the gasoline from the small portion of treating solution carried over with the gasoline. In addition to these two vertical columns, an open top iron vessel was set up, about 250 gallons capacity, conical at the bottom, in which the operators mix the bleaching powders with water when making up a batch of treating solution. When the solution has settled clear, part of it is drawn away into a blow case buried near the columns, and when the solution in the first, or contact column, begins to lose its treating effectiveness, it is built up by adding the contents of the blow case, transferring the solution from it to the first column by applying gas pressure from the residue system.

The contacting column, is fitted with a two-inch pipe loop, connected to the shell at two points; one of which is near the base and the other about four feet higher up. Long two-inch pipe collars were welded to the shell of the column to establish the beginning and ending of the loop. Short nipples were made up into collars, and on the lower connection an ordinary two-inch cast iron plug valve was fitted. At the upper connection, a two-inch screw end, iron body, brass mounted, gate valve was provided. Continuing with the connection work from the upper point, a nipple and a malleable two-inch tee, was fitted. From the side outlet of the tee, the line continues downward with a three-foot nipple, having a quarter-inch collar welded near the center for a sample cock connection. The necessary two- by one-inch cast iron bushings were used to reduce the size of the con-



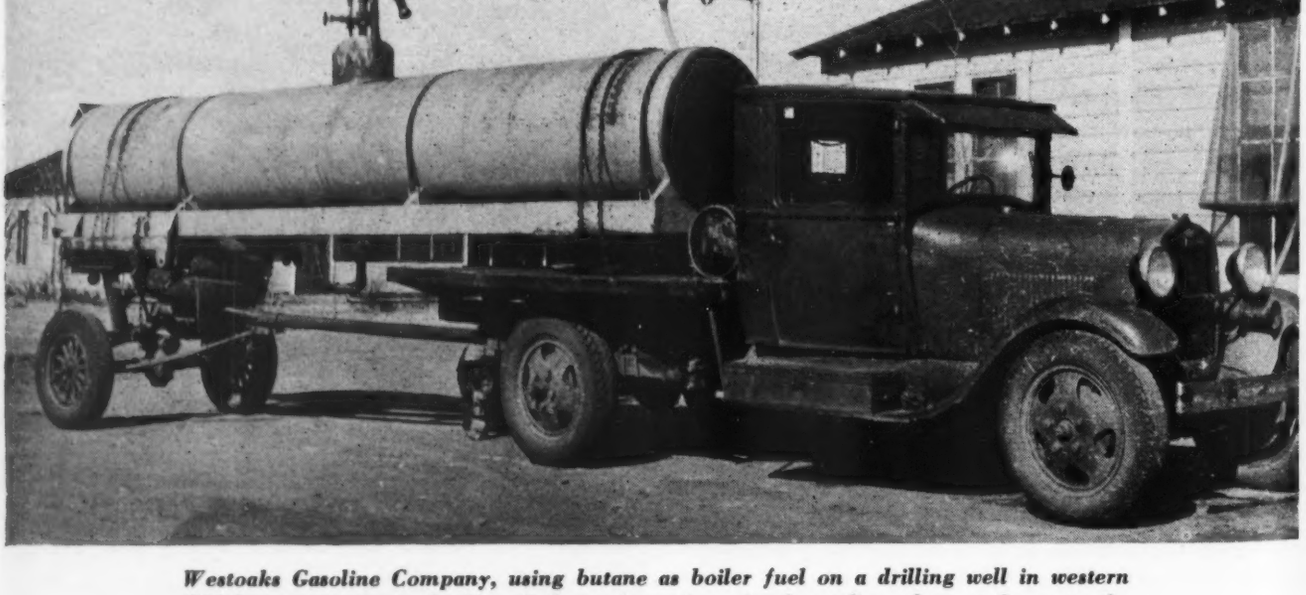
Details of jet and loop at base of treating column used to secure circulation of chemical and intimate contacting.

nections so that a one-inch jet could be inserted in the loop with one-inch lip unions provided for convenience in making up the connections and removing the jet for cleaning. This set up completes the loop.

For making up solution strength in the column, a two-inch line was continued from the open end of the upper tee, continuing with a two-inch by 12-inch nipple, and then dropping to the ground by connecting to the ell a two-foot nipple, a cast iron plug valve and sufficient pipe to reach to the buried blow case near the base of the tower.

To operate this treating plant, calcium hypochlorite solution is placed in the column through the blow case until the level of the treating liquid is considerably above the lower connection of the jet. contacting loop but always high enough that the solution never falls below the lower connection. Then, gasoline from the stabilizer after-coolers is admitted to the center of the jet in the treating loop, under about 190 pounds pressure—the normal pressure under which the stabilizer column operates when manufacturing 26/70 natural gasoline. The gasoline is admitted to the center of the jet through a three eighths-inch line, being reduced from one-inch a short distance away from the loop. One-inch line is used to transfer the stabilized natural gasoline from the after-coolers to this point, where a one-inch gate valve is inserted to control the amount of gasoline being admitted to the mixing apparatus. The volume is controlled by manual operation of the valve, and is fixed to correspond to the amount being processed through the stabilizer.

Since the stabilized gasoline released through the one-inch valve to the jet is under much higher pressure than the operating pressure of the column, this causes the calcium hypochlorite solution contained in the base of the contact column to circulate upward through the two-inch loop and back to the column; being mixed intimately with the gasoline within the jet itself and the loop before entering the tower. Once the gate valve on the gasoline line leading to the jet has been adjusted to the rate of production and the output of the stabilizer, very little attention to the routine operation need be given the apparatus. After a series of runs had been made with normal strength treating solution, the operators of the plant are certain to know when to renew the solution in the column before the gasoline passes through off specification. Re-treating of the gasoline has not been necessary except when the solution was neglected and had become too weak to remove the objectionable compounds in the raw stabilized product. The apparatus has been in operation for more than two years, and during this time, it is stated, the cost for chemicals has averaged around five cents per thousand gallons of gasoline passed through the installation.



Westoaks Gasoline Company, using butane as boiler fuel on a drilling well in western Oklahoma transports the liquefied gas from its natural gasoline plant at Sayre to the well location in a 1000-gallon tank truck.

Emulsions . . .

ROUGHLY speaking we have two forms of emulsions, the simple emulsion and the complex. The first is taken to be a simple suspension of one element of the emulsion in the other. In the complex emulsion one of the elements is present as a film over the suspended globules, and it is the latter class with which we most often deal. To get good neutralization and thorough washing it is necessary to get emulsions of a sort. In controlling these emulsions our effort must be to keep them as near the simple stage as possible.

The first point of control lies in the neutralization of the sour acid treated oil, and the first step in the neutralization is the choice of a suitable strength of soda solution for the purpose. In all emulsions there is a balance between the proportions of the oil and the water present. The permanence of any emulsion formed depends to a great extent on this balance and in general it may be said that the solution side should be kept as low as possible. This naturally means the use of a reasonably strong soda. A strength of about 15° Be. will be found about right for general purposes.

It can be safely said that most emulsions are started when the soda solution is pumped on to the sour oil. There is a time, particularly when the pumping starts, that a small quantity of acid soda salts are present in a large excess of sour oil. At this stage the acid emulsion begins to form. Sour oil globules are covered by a film of the acid soda salt solution, and this not only gives a more or less permanent type of emulsion, but it effectively cuts off the penetration of fresh soda to the inclosed sour oil globules. Where weak soda is used this action is particularly marked, and as the mixture ends with a high water balance when the pumping is finished, a reasonably permanent emulsion can result.

More often than not an emulsion which has been strongly alkaline when the neutralization was considered finished, will go strongly acid when allowed to stand or when steamed up. This is due to the gradual breaking down of the emulsion film which liberates the inclosed acid oil. This sort of thing does not usually occur when the soda used has been of a strength of 15° Be or stronger.

TO physical chemists, emulsions have given the opportunity for much expression, but unfortunately few results so far as the treatment of petroleum oils is concerned. To the treater they have also given cause for much expression, but it, also unfortunately, is not of such a character that it may be committed to paper of the usual quality. Further, not being able to pour a thousand barrels or so of a sticky mess down the sink, the treater must needs tighten his belt and clear it up.

"But his methods are so crude, so rule of thumb," the scientific man tells you.

It's worse than that. His methods are not even rule of thumb. The treater who handles emulsions when and as he finds them must be a sort of magician. From long hours spent, not over books but over hot agitators, he has accumulated instincts in regard to emulsions and a considerable bag of tricks. In a tight place he simply takes out one trick after another until he finds one which makes the break. And the younger breed of treaters should note this: regardless of what the books say on the subject of emulsions, success comes easiest and most often to the man with the biggest bag of tricks.

It is obviously impossible to lay down a set of general rules for the handling of emulsions in the treating of petroleum oils. Each treater will develop his own technique, based on the oils with which he is working, and will develop an instinct with regard to the changing condition within the agitator. When a batch of oil has gone "soupy" there is little that one can do except to fall back on experience and the good old bag of tricks, but by a study of conditions it is entirely possible for an experienced treater to go far toward preventing emulsions or at least to get them in such shape that they are easily broken if they do form.

NEUTRALIZATION

In working out the treatment of a particular grade of oil it is well to give particular attention to this matter of neutralization. Too often such a determination covers only the chemical neutralization and the work is done on only a small quantity of oil, to which the soda is added practically all at one time. This does not duplicate the physical conditions of a large scale plant neutralization. The experimental work should be done on at least 10 gallons of sour oil and the soda should be added at approximately the rate at which it is pumped on the agitator in the plant batch. Where this is done and trouble results it will often be found advantageous to increase the strength of the soda over that generally used.

Very often no particular effort is made to determine the total soda necessary to neutralize a batch. The regular strength of soda is pumped on until the batch is slightly under the neutralization point. The

pumping is stopped and the batch agitated until it is quite acid again. At this stage we have the acid emulsion which is a potential trouble maker, particularly on an oil which has been subjected to a high acid treat.

After this agitation more soda is pumped on and the batch agitated and tested again. This is continued, an effort being made to hit an almost exact neutral point, but this is seldom reached. Quite often the batch actually stays acid, as there is not sufficient soda present to neutralize all the sour oil. This is apt to occur if no alcohol, or benzol-alcohol has been used in the test solutions as will be explained later.

It is far better to determine the soda necessary to fully neutralize each batch by the regular titration method, using soda of the same strength as will be used in the plant neutralization. In preparing the sample for this titration it should be shaken up with a mixture of 50-50 benzol-alcohol. This mixture breaks up any acid emulsion which may have formed and keeps all the acid free. It is usually safe to add a small percentage of soda over and above that required to actually neutralize the batch, thus insuring that the neutralized batch will be well on the alkaline side. On highly treated oils this is necessary and it will generally be found that an alkaline emulsion is easier to handle and that the oil is much less likely to go off test in the breaking of the emulsion, than one which has been stopped on the acid side.

The quantity of soda solution having been determined this should be pumped on the agitating batch as fast as possible. When it is all on the agitation should be continued until tests show that the batch is entirely alkaline. The benzol-alcohol solution should be used on this test also.

An excellent method of adding soda is to put it into the pump while the sour oil is being transferred from the treating to the neutralizing agitator. By this means the oil can be kept on the alkaline side at all times and considerable trouble avoided.

With some oils which have not been so highly treated it is possible to run slightly under the neutralization point or very near it. In this case weak soda (2° Be. or 3° Be. soda) is used with the idea of saving later washing. In the plant where such a method is used the particular oils have been treated in the same way, by the same men for a number of years, and their experience carries them over. For general use, however, soda of such strength cannot be advised.

On neutralizing the heavier oils where the treating has been carried to 60 pounds per barrel or higher or even on transformer oils where the treat has been carried as high as 250 pounds per barrel of fuming acid the following scheme of neutralization has worked out well:

Approximately 25 percent of the batch is held out while the total soda necessary to neutralize the whole batch is pumped on the remaining 75 percent of sour oil, and thoroughly agitated. An alkaline emulsion usually forms and this is broken by pumping on the remaining 25 percent of sour oil.

SOUR OIL

Incidentally, sour oil is one of the best agents for breaking emulsions. Where trouble is expected it may pay to hold out some of the batch as described above, and care should be taken that plenty of soda is pumped on the first portion in the neutralizing agitator.

After neutralization the batch is usually brought up to a temperature in the neighborhood of 160°F. and the suspended soaps allowed to settle. This generally takes over night. When the heavy soaps are drawn off, more water is added and the whole mass heated and agitated with live steam. It is at this point when bad emulsions usually come. Many times the batch will wash beautifully, the milk-water will break out thin and white and the oil show signs of breaking clear. This continues until at some point, usually in the neighborhood of 200°F. when in a flash the batch will turn into a sickly mess.

TEMPERATURE

The matter of temperature is critical in the formation of emulsions and in the thorough washing of neutralized oils. This is particularly the case with oils which have been given heavy acid treats. Generally any oil which can be neutralized with soda can be carried to 180°F. without the use of live steam without turning over. In some cases experience has shown it possible to use live steam, and allow the temperature to rise slowly, cutting it off when the appearance of the batch indicates that the danger point has been reached, but this practice is only safe in the hands of an experienced treater who is thoroughly familiar with his particular oils. Many times too, this practice does not give thorough washing, and subsequent washes give trouble.

If instead of using live steam for heating and agitation, air be used, with sufficient coil steam to bring the temperature up, many bad emulsions may be avoided, and at the same time a thorough washing carried out. It seems that the severe mechanical agitation by the live steam as well as its condensing in the oil both tend to produce emulsions, and especially in the case of highly treated oils where they must be thoroughly cleaned up it is well to do away with live steam. In cases where the condensation from the coils can be returned to the boiler house and very considerable saving can be worked out from this source.

Whether live steam or coil steam is used for heating, the matter of water balance is always of im-

portance. It is not generally recognized, but much trouble from emulsions and poor washing, which runs the washing losses up, come from too high a proportion of water being used for washing. In many cases it is the practice, after the heavy soaps have been drawn off, to pump on an indeterminate quantity of water and then turn in the live steam. The agitation continues until someone decides to stop it, the appearance of the batch usually governing this. By this time the water present has greatly increased but there has been no effort to control the quantity, and probably no effort to determine the proper proportion which the water volume should be allowed to reach. Concerns operating on this principle have a noticeably larger number of bad emulsions than ones who exercise some control over the water balance.

PROPORTION OF WATER

It is possible to determine from experiment, the proportion of water to oil which gives good washing and a minimum of trouble. In plant practice a fixed minimum of water is pumped on and the live steam turned into this. The steaming is continued until the water volume has increased to the determined figure when the steam is shut off and the wash water allowed to settle. In this way it is possible to discount differences in the quality of the steam as well as seasonal and other temperature conditions which increase or decrease condensation.

There is a method of neutralization which may also be applied to the washing of oils which brings both the matter of temperature and water balance under control. This method is advanced by H. G. Fowler, and is included with other details in a patent which covers the Fowler process.

Fowler has found that if an acid treated oil be neutralized with soda in the cold; sufficient soda being added to carry the batch well to the alkaline side, and the temperature of the oil-soda mixture be raised quickly to 180°F. or higher, the soaps will break clear, settle rapidly, and give a superior quality of oil.

In using this method it is possible to determine the strength of soda, the temperature and the proportion of the wash water to give the best results. It brings neutralization and washing problems under reasonable control and it is a fact that oils which have been subjected to very high acid treats can be successfully neutralized and washed without the use of alcohol or any sort of emulsion breaker.

HEAT MAY CAUSE TROUBLE

In using this method on a plant scale, the batch of sour oil is neutralized with soda of a proper strength and agitated with air until the soda has taken full effect. That is, until the batch does not go acid on standing. This is very important as putting heat on an acid emulsion, even though an excess of alkali be present, is liable to cause trouble. Two tanks or agitators are required with a heat exchanger between them. This exchanger should be sufficiently large to raise the temperature of the oil-soda mix from approximately 70°F. to a temperature between 180 and 190°F. at one pass. Care should be taken that the temperature in the exchanger does not rise above the boiling point of water as, particularly with a highly treated oil, steaming is almost certain to produce a bad emulsion. After the transfer through the exchanger the hot batch is allowed to settle in the second agitator. If the conditions have been properly worked out the heavy soaps will settle quickly and will carry a minimum of good oil. In washing such a batch, where it is necessary, the soaps are drawn off and the determined proportion of water added. It is then circulated to bring it up to temperature, thoroughly agitated and allowed to settle.

The quick rise in temperature is apparently essential. If, on the first heating, the mix be circulated through the exchanger and back into the agitator again the best results cannot be expected, as the temperature of the batch rises too slowly. While the results will be better than when live steam is used, there is not the striking improvement in results which are shown by Mr. Fowler's method.

In applying this method, however, it must not be assumed that one can discard experience, go through the operations as directed, and get results. Though the proposition is under closer control, the details of that control must be carefully worked out to cover the case at hand. The fact remains that if the method be taken in hand by an experienced treater and worked out in accordance with his knowledge of his own processes, he will find his troubles reduced, his yields increased, and that he can neutralize higher acid treats than he has by other methods, to make better quality oils.

In the manufacture of transformer oils, turbine oils, etc., to meet certain high grade oxidation tests it has been found that the use of live steam tends to throw them off or at least make them unstable. In the manufacture of such oils the Fowler method of neutralization is especially valuable.

SOAP SOLUTIONS

As an aid to washing oils and as emulsion breakers, various soap solutions are sometimes used. Black acid and the so-called green-acid soaps are made from the acid sludges which come from treating petroleum oils. Rosin soap seems to have had a more general success than any of these, due probably to the fact that it is a more uniform product. In the matter of soaps it has been noted, that for a little time after their trial and adoption the results created quite a little interest and excitement, but after six months or a year they have dropped out of use

entirely. This would indicate that soaps as a rule are not a great success.

With bad emulsions acid is often used as a breaking agent. When this is used a certain quantity of material is thrown back from the soaps into the oil, and while a large quantity of acid salts may be dropped out, it is not unusual to land in a bad mess when the batch is reneutralized. The very presence of the acid soda salts is a harmful factor, and in any event there is a loss of quality.

When turbine oil, transformer oil, or any oil of like grade is being processed and it is necessary to break an emulsion without loss of quality, strong soda solution, 44° Be. or stronger, is an excellent agent. This is a bit more expensive than acid as far as the reagent itself goes, but it does save the quality, and on an oil of this grade quality this means money. This soda is pumped on the hot batch, a little at a time, with agitation between pumpings until a break occurs. Better try a break on a small scale first in order to see exactly what does happen. In washing the oil after such a break some trouble may be experienced. Here again too much water should not be used. In the final washes on an oil, as well as at the time when larger quantities of soaps are present it will be found that the water balance in the agitator exerts a marked influence on the clarity of the settled oil. Very often a small quantity of water will gather the soaps and take them down much better than a large quantity, and a little experimentation along this line is worth any treater's time.

There is another method of breaking bad emulsions without ruining the quality of the oil. Enough soda is added to the mix to make it alkaline. Coil steam and air agitation are then turned in. The temperature is carried up as high as the coils will take it, and the mix is blown strongly to evaporate the water. Samples should be taken from time to time as a stage is generally reached where the break occurs and the soaps settle out. If this does not occur the batch is blown practically dry. Water is then added and the batch washed in the usual way. The necessary proportion of wash water should be determined by experiment.

A point which is worthy of attention is the shape of the tank or agitator used in neutralizing, washing, and settling oils. In the majority of cases this settling is carried out in a tall, comparatively narrow agitator. Generally the soaps drop together at first, but almost from the start convection currents are set up and the finer globules of soaps and emulsions are carried up into the cleaner oil. The height of the average agitator is such as to give considerable head to these currents and increased velocity. Once the lighter particles are carried up there is nothing to take them down again against the rising currents. As a result there will be a cloudiness and a light emulsion in the settled oil, and additional washing will be necessary. It will be noted that one can seldom take the brilliant settled oil off a tall plant agitator that will come from a portion of the same batch which has been settled in a beaker or in a small experimental agitator. If the tanks or agitators used for this purpose be built not over 20 feet high, and broad accordingly to get the volume, a considerable saving in settling and washing time can be effected and a much better quality of oil will result.

One day there was an emulsion which was just on the edge of breaking, but it had been riding that edge the whole of a sweltering day. Finally, Al, the treater, came down the runway with a piece of plank over his shoulder. He lashed this to the end of his circulating line coming into the agitator in such a way that the incoming stream would strike it and spread out. He started his pump—slowly so that the stream of oil would not be too thick over his plank. Darned if it didn't break. That is another trick in the bag? Once in a thousand it works.

Solvent Reactivation of Spent Contact Filter Cake

(*Continued from page* 136)

vided with receiving tanks. It must be kept in mind that from these we get a separation of either water or weak alcohol, which must be drawn off before the solvent can be put back into the system.

Vacuum pump—L. This had better be recommended by the dryer manufacturer. The rotary types are very satisfactory, but with the oil sealed type some trouble may be encountered due to the solvent diluting the sealing oil. While this should be considered, it is a difficulty that can be overcome.

Solvent recovery unit—N. The solvent recovery system must act as a seal as well as a scrubber for the exhaust of the vacuum pump and for any air or gas vented from the system. Aside from its economic value it has some necessity from a safety standpoint as it prevents the escape of any large amount of light solvent through accident or otherwise.

While there is nothing particularly complex about the design of such a unit it must do its work thoroughly and it must of necessity be compact. The layout shown in Figure 5 is based on a German design which has been used successfully in connection with the Otto-Wilhelm extraction system. The failure of extraction plants in other industries has may times come through faulty solvent recovery methods. This layout and description are given to bring out clearly the problems involved. The items described will be found on Figure 5.

Expansion tank—A. This tank should be about three feet in diameter by four feet long. The vapor lines should be as large as possible in order to keep the velocity low.

Scrubber towers—B. These are about 12 inches in diameter by 10 feet long. These are packed with Raschig rings. The half-inch size is right. These are small chemical stoneware thimbles of the length and diameter given. They are dumped into the towers, no effort being made to arrange them. At the top is placed a perforated metal plate to evenly distribute the wash oil coming in through line 5. The towers are connected together as shown.

Hourglass seal tanks—C and D. These tanks are each two feet in diameter by about three feet long. *C* is an expansion tank. The line out of its bottom goes almost to the bottom of *D* where it ends in a cross whose arms are drilled with quarter-inch holes. About 12 inches of wash oil is maintained in tank *D*.

Vent—E. This is a six-inch pipe. It is packed with half-inch Raschig rings. At the top of the packing wash oil is fed on to give the escaping gasses a last scrubbing. This oil drains out of the vent into tank *D*.

Stripped wash oil tank—G. Rich wash oil tank—F. These tanks may be of any suitable size and are located one above the other as shown.

Stripped wash oil circulating pump—H. Still feed pump—I. Circulating pump—Still to stripped oil tank —J. H, I and *J* are small gear pumps.

Cooler—K. This is a small coil and tank cooler. If desired it may be used as a heater for rich wash oil before it goes to the still.

Still—L. The body of this is a 12-inch pipe. It is heated by a steam coil. This is a spiral of half-inch pipe bent on a diameter that will just fit inside the still body. The inlet and outlet pass through the bottom plate of the still. The body is filled to the top with Raschig rings. The rich wash oil is fed in through line 8, and goes on a distributor of some sort which is placed on the top of the packing.

Rectifying column—M. This is a section of four-inch pipe about 10 feet long. It is also packed with Raschig rings and is provided at the top with an inlet for the reflux.

Condenser—M. This is a small tube and tank condenser.

Regulating box—O. This is a small adjustable weir box by means of which the solvent stream coming off the still is split and part of it sent back as reflux to the rectifying column.

The vapor line carrying the exhaust from the vacuum pump and into which the various vent lines have been manifolded, comes into the expansion tank *A* as line 1 and leaves as line 2. The vapors pass through the scrubbers as shown by the arrows, leaving them through line 3 and enter the seal tank. They enter the expansion *C*, then pass down through line 4 and into the *D* section of the tank through the holes in the cross. The gases get their final scrubbing in the vent. The plant should be so operated that no odor of solvent comes off the vene.

The wash oil circuit begins at the stripped wash oil tank *G*. The pump *H* sends it through the scrubber towers and through the vent, each of which is provided with a regulating valve and a sight glass to control the wash oil stream. The rich oil leaves the towers at the bottom through line 6. The tank *A* and the overflow line from tank *D* are also tied into this. The bottom of tank *D* may also be tied in for occasional draining. The line 6 goes to the rich wash oil tank through the seal as shown.

In working the system it may not be found necessary to operate the stripping still continuously. In such a case the valve in line 11 is opened and the wash oil allowed to circulate until the solvent reaches such a content that the oil must be stripped.

When the still is operated the rich wash oil is fed continuously by pump *I*. If so desired it may be sent either through the outside of the cooler *K* or through a small steam heater. The wash oil circulates down

through the still, the solvent is taken off and the stripped wash oil is returned to tank *G* by the pump *J* through the line 9, the cooler *K* and the line 10.

The vapors go up through the rectifying column and are condensed in the condenser *N*. The solvent stream is split in the control box *O*, the reflux goes back to the column through the seal 13 while the remainder goes to solvent storage.

In the solvent recovery section should be a couple of small coned-bottom settling tanks provided with gauge glasses which run to the bottom of the cones. They may be made from sections of 12-inch pipe and are about six feet long. With water as a replacement agent the separated material may be run to waste. With alcohol the separation is run to a slop tank and held until there is sufficient for a still run. The clear solvent is pumped to storage.

In operating the reactivation system the charging tank is filled about half full of naphtha and the agitator started. Sufficient spent cake is then charged through the hopper and the cover put on. The remainder of the naphtha necessary to make up an extractor charge is then run in and the agitation continued for about five minutes. When the cake is well mixed in and in a condition to pump it is pushed on to the extractor basket by the charging pump through the line 1 (Figure 4).

This first stage or naphtha extraction is for oil removal only. The solvent flow is set to run from the receiver D_1, through the extractor and Nutch filter to still E_1. The distilled solvent returns to the receiver through the condenser C_1. This oil extraction takes approximately one hour.

After this stage is finished the lines are switched to bring the flow from D_2, the receiver for the reactivation solvent. The first water or alcohol, or other replacement agents is added at this time. Additional is added at the beginning of every hour until the reactivation is complete. It has been found more economical to operate in this way than to carry a constant flow of the replacement agent with the solvent, even though, as is the case with benzol and alcohol the replacement agent is dissolved in the solvent. A little experimentation will determine just how fast the replacement agent is taken up by the clay and this will give the rate at which it is to be added.

Plate I is a schedule of 15 hours of running the three-extractor plant including the starting cycles. The extractors are run on a five-hour cycle; one hour on oil extraction and five hours on reactivation. The oil extraction is run on a single extractor circuit. In the reactivation stages the solvent flow is from the receiver D_2 to the extractor longest on stream. The extract from this goes to the extractor shortest on stream, whose extract goes to the still E_2. This is a sort of two-stage counter-current extraction. While the clay does not move against the stream of the fresh solvent the latter half of the reactivation is run on fresh solvent.

It has been found that more than two stages in the reactivation cycle are bad. The problem is to get the replacement material on the clay. The extraction follows as a matter of course. It has been found, further, that there is some pick up of coloring matter in the early stages of, say, a five-extractor counter-current cycle. The color matter in the solvent is quite concentrated when it reaches those stages and the heavy matter apparently replaces some of the lighter already on the clay. This increases the work of the last stages and almost doubles the time of reactivation. Two stages give plenty of time for the replacement and at the same time the coloring matter concentration is such that it does not again go on the clay. In a three-extractor plant it will be noted that each extractor is held off stream for an hour after its charge has finished. This is necessary in order that it may be ready to take its proper place in the cycle.

As is the case with the laboratory apparatus, the color of the extract stream is no indication of the progress of the reactivation. A clean stream does not mean that the job is finished. Much of the time the stream coming off a finished extractor will be black. The reactivation can easily be run on a time basis, with regular check samples being taken from the extractor and tried on a standard oil. Such samples can be dried quickly by spreading them on a paper towel or by drawing air through them on a Buckner funnel.

If a thickener be not used in the system the solvent

Schedule for Extractor Operation

Extractor	#1		#2		#3		
Hour	From	To	From	To	From	To	
1st.	D_1	E_1	...	...	...	...	....
2nd.	D_2	E_2	...	...	...	...	....
3rd.	D_2	E_2	D_1	E_1	...	...	....
4th.	D_2	#2	#1	E_2	...	...	....
5th.	D_2	#2	#1	E_2	D_1	E_1	#1 out
6th.	...	...	D_2	#3	#2	E_2	....
7th.	D_1	E_1	D_2	#3	#2	E_2	#2 out
8th.	#3	E_2	...	...	D_2	#1	....
9th.	#3	E_2	D_1	E_1	D_2	#1	#3 out
10th.	D_2	#2	#1	E_2	...	...	....
11th.	D_2	#2	#1	E_2	D_1	E_1	#1 out
12th.	...	...	D_2	#3	#2	E_2	....
13th	D_1	E_1	D_2	#3	#2	E_2	#2 out
14th.	#3	E_2	....	...	D_2	#1	....
15th.	#3	E_2	D_1	E_1	D_2	#1	#3 out

D_1—Oil Solvent Receiver.
D_2—Reactivation Solvent Receiver.
E_1—Oil Solvent Still.
E_2—Reactivation Solvent Still.

in the charge in the extractor basket may be allowed to run low. This is done by cutting off the flow of fresh solvent. This thickens the charge in the extractor itself and it may be drawn direct to the dryer feed tank. With a thickener in the line this thickening time need not be taken and the finished batch is drawn directly to the thickener feed tank.

The dryer and thickener end of the plant is operated exactly the same as that part of the plant described for handling spent contact filter cake in a previous article. (REFINER, Vol. 12, No. 12, Dec. 1933, page 484). Here the solvent taken off by the thickener is returned to the solvent receiver D_2.

The only difference in this operation and that previously described is in the material drawn from the dryer condensers. Here we have water or weak alcohol which must be separated. Every precaution must be taken that this separation is complete as excess moisture is certain to cause trouble in the extractors and later in the thickener, by giving a sticky, muddy cake which plugs the filter cloths.

If this separation be weak alcohol it will be of a strength of from 30 percent to 40 percent by volume. It is pumped to the solvent recovery separators already described, then held in a storage tank until sufficient is on hand for a still run, which may be made in the still which is a part of the solvent recovery system. This involves taking the still off its regular work for about 10 hours, but as the recovery system is not working under a heavy load this is easily possible.

The reactivated clay as it comes from the dryer will run like water. It may be either run into a bin and to a bagger, or it may be taken to its bin in the contact treating plant by a suitable suction conveyor.

The plant layout shown may seem complicated. It is true that most extraction systems carry out the entire operation in the extractors themselves, but it seems more reasonable and has proven more economical to keep the extractors in operation as efficient extractors rather than a large portion of their time at work as inefficient dryers. The final drying of this fine clay can only be done well if the cake is stirred up and broken. The logical place for this operation is a vacuum dryer. A plant for fine clay reactivation is a large enough proposition that each operation may be given its proper place and equipment. There is no need attempting to combine them both in one machine.

In a plant of this sort, as will be shown later, a large portion of the cost of the process can come from solvent losses. The plant as designed has only three openings: one at the hopper where the spent cake is loaded into the charging tank; one at the dryer where the reactivated clay is discharged; one at the vent in the solvent recovery system. Everything else should be kept tight and as none of the regular openings offers a very great opportunity for the escape of vapors, it should be possible, with reasonable care, to keep the solvent losses at a low figure.

The real success of any reactivation system naturally hinges on its cost. The figures shown below represent a fair average for any type of filter cake. Costs on three methods are given; naphtha-water; naphtha-alcohol; and benzol-alcohol. They are based on semi-scale plant runs of a complete five-extractor plant having a minimum capacity of one ton per 24 hours. They are worked up for a three-extractor plant of a capacity of 30 tons per 24 hours, costing in the neighborhood of $50,000.00.

The spent cake from which they are taken was from a high-powered California clay. It had been used on a Coastal stock of a Saybolt viscosity of 70 seconds at 210° F. It carried an average of 21 percent/weight of oil and nine percent/weight of tarry coloring matter.

The costs are given per ton of spent cake handled.

HEAT COSTS

	Naphtha-Water	B.t.u. Naphtha-Alcohol	Benzol-Alcohol
Extractor heat	392,085	389,837	397,402
Still heat	2,471,100	2,471,100	2,143,327
Dryer heat	423,520	381,376	427,996
Recovery plant heat	69,660	69,660	69,660
Weak alcohol recovery	.....	15,000	15,000
	3,356,365	3,326,913	3,053,325
Radiation loss—25 percent	839,071	831,753	763,331
	4,195,456	4,158,666	3,816,656
Lbs. steam—970 B.t.u./Lb.	4,326	4,287	3,935
Cost—Steam at .30 per 1000 lbs.	$1.33	$1.28	$1.18

The heating cost will naturally vary with the time taken for the reactivation. If these figures are to be held down a close check must be kept on the flow of solvent through the extractor. Care must be taken that the dryer batches are uniformly thickened and that too much solvent does not get by the thickener. A thin charge to the dryer requires just that much more heat to evaporate the solvent and of course cuts down the dryer capacity for clay.

SOLVENT LOSSES

	(Per ton of cake)	
Naphtha-water	3.7 gals. naphtha at 5.4c	.20
	* * * *	
Naphtha-alcohol	3.7 gals. naphtha at 5.4c	.20
	6.0 gals. alcohol at 30c	$1.80
		$2.00
	* * * *	
Benzol-alcohol	5.0 gals. Benzol at 22c	$1.10
	6.0 gals. alcohol at 30c	$1.80
		$2.90

These losses are high figures. With reasonable care in operating, in preventing spills and detecting leaks, they can be brought down much lower. On the other hand carelessness can send them much higher.

LABOR COSTS

1 Operator 24 hours at 70 cents	$16.80
1 Helper 24 hours at 60 cents	14.40
1 Laborer 24 hours at 50 cents	12.20
	$43.30
Cost per ton of cake	$ 1.45

The labor cost will vary somewhat with the location

and method in which the plant is used. Where the cake is brought from a dump or the plant is a unit by itself, then the three men will be required. If it be a part of a contact treating system where the cake comes direct from the filters, or where part time labor is available then the regular force may be cut to two men or in some cases one man can handle the plant.

POWER COSTS

Extractors	10	horsepower
Dryer	20	horsepower
Vacuum pump	7.5	horsepower
Incidental	7.5	horsepower
	45	horsepower
Horsepower hours 30 tons cake	1080	
Horsepower hours per ton cake	36	
Cost at 1c per K.W.H.	.27	

WATER

12,000 gals. per ton cake, 1.5c per 1000	.18

INTEREST, TAXES, ETC.

10 percent on cost of plant	$5,000.00
10,000 tons of cake per year. Cost per ton	.50

DEPRECIATION

7.5 percent on cost of plant	$3,750.00
10,000 tons of cake per year. Cost per ton	.375

SOLVENT IN SYSTEM

Value of benzol in system	$ 330.00
Value of naphtha in system	81.00
	$ 249.00

The use of benzol carries an additional charge of 2.5 cents per ton to cover this item.

There will be 15,000 gallons of solvent required for the operation of the plant. With naphtha the cost of this is included in the cost of the plant. The addition cost shown for benzol is 10 percent on the difference between its cost and the cost of naphtha.

OIL AND TAR IN CAKE

For a cake which carries 21 percent of oil and 9 percent of tar.	
420 pounds of oil. 55 gals. at 8c	$4.40
180 pounds of tar. 23 gals at 3½c	.91
	$5.31

It will be seen that the value of the oil and tar recovered are roughly equal to the cost of reactivation. Naturally this figure will depend on the value placed on the products. The tar will carry a fuel oil value in the neighborhood of 3½ cents per gallon. The oil will vary from 3½ cents to 10 cents per gallon.

VALUE OF CLAY RECOVERED

The value of the clay recovered will depend on the value of the clay when fresh, on the efficiency of the reactivation, and on the way the reactivated clay is to be used.

If benzol-alcohol or naphtha alcohol has been used, 100 percent efficiency is reasonably certain. This reactivation has been repeated nine times. With water the resulting efficiency is more uncertain. Only experiment will show what the value will be. Here again it must be emphasized that a plant test is the only real criterion. Under the circumstances there will be no figures covering the value of the recovered clay included in these costs.

TOTAL COSTS
(Per ton of spent cake reactivated)

Labor	$1.45
Power	.27
Water	.18
Interest, taxes, etc.	.50
Depreciation	.37
Costs common to all methods	$2.77

	Naphtha-Water	Naphtha-Alcohol	Benzol Alcohol
Naphtha loss	.20	.20	....
Steam	$1.30	$1.28	$1.18
Benzol loss	....	....	1.10
Alcohol loss	....	1.80	1.80
Benzol stock	....	....	.02
Common charges (see above)	2.77	2.77	2.77
	$4.27	$5.05	$6.87
Value of oil and tar recovered	$5.31	$5.31	$5.31

THE SOLVENT REACTIVATION OF COARSE PERCOLATION CLAYS

In Europe the solvent reactivation of coarse percolation clays is practiced to some extent. This is generally done in small refineries where the quantity of clay used is not large enough to justify the cost of furnaces for reburning. Fullers earth is imported and is more expensive than in this country, while the cost of benzol is somewhat lower.

The reactivation is carried out by circulating the benzol-alcohol mixture through the clay bed in the percolation filter. In some cases the alcohol is circulated alone and followed by washes of benzol. While the reactivation is successful enough, it is expensive and is not used where the amount of clay handled will justify the cost of equipment for reburning.

While many patents have been issued on solvent combinations for the purpose of reactivating fine contact filter cakes, not much work has been done on the practical side of the problem. Up to now it has always been considered that the process would be too expensive, but it will be seen that if it be carried out in a tight system, where the losses are kept at a minimum, there is no reason why it cannot be made a thoroughly practicable and profitable procedure. In this country there are many large piles of spent filter clays. In most cases they are more or less of a nuisance and something of a fire risk. They represent quite a value if the clay can be brought back to any extent at all. The oil and tar in these clays would go far toward paying the cost of reactivation.

Western Refiners Are Told Federal Control Is Likely

AFFAIRS of national importance in petroleum held the spot light on the program of the annual convention of the Western Petroleum Refiners Association at Excelsior Springs, Missouri, April 5 and 6. The possibilities of absolute control of the industry by federal statute were presented at the meeting the second day. The directors named a committee of nine to meet with other representatives of the industry in New York to prepare a program for uniting the industry on a program which is to be offered instead of the legislation under consideration.

Fayette B. Dow, Washington counsel of the association, discussed the national industrial program and its relation to the petroleum industry. He pointed out that control of industry by government is not of recent birth but has been growing over a long period. In regard to proposed legislation for control, he said he understood that the proposal was to place the industry under the supervision of a board similar to the Interstate Commerce Commission.

"It is a control of the utility type," he explained. "My own opinion is that the oil industry is unsuited for such control. You must realize that the Interstate Commerce Commission has exceptional authority of the railroads and yet it has not been able to guarantee prosperity for that industry. In my opinion Washington is trying too much."

He offered three proposals as a program for the industry to offer instead of absolute control by government: control of crude oil production by federal statute; control of refinery operation and the purchase of surplus gasoline; relief from taxation.

The public interest, he suggested, left but one answer to the regulation of crude oil output. Oil is an irreplaceable product and for that reason should be taken from the ground only as needed and under conditions that assure the greatest recovery. He said that the control of refinery operation should be linked with the buying of gasoline, the buying to be done by the larger companies and it should continue even to the extent of halting operation of plants owned by the buying concerns. His thought was that this sort of buying should be looked upon as permanent policy rather than a temporary expedient.

W. R. Boyd, Jr., executive vice president of the American Petroleum Institute, New York, called attention to the recent passage of the Bankhead bill for regulation of cotton production. "Although," he explained, "I am confident such legislation is economically unsound, I realize that it is to be carried out.

"We need constructive leadership to form a program which will avoid such a regulation for the petroleum industry. I think the threat of federal control is a real one. If attempted it will be carried on until it breaks down of its own weight but I am afraid some of you will not be here when that happens."

B. L. Majewski, a member of the Planning and Coordination Committee, gave more details concerning the proposal for absolute control by government. "The bill has been written," he said, "it would set up a board of five members. It would establish quotas in commerce. Imagine being told how many service stations you may maintain or build.

"Thus the oil industry is on dangerous ground because it has failed to adopt a unified program."

Lack of a unified program, he said, was evident from the time the effort was made to form a code in Chicago in June, 1933. "We couldn't get together there and we couldn't get together later in Washington. The result was that this industry did not form a code. It was handed a code one hot night in Washington.

"The code should be rewritten and rewritten by the petroleum industry. It should be our code. The automobile industry would not be forced into a code it did not like. The coal industry has one of its own. Why not one that represents what the petroleum industry wants?"

The technical program was confined to the afternoon of the first day of the meeting. One paper "Refinery Engineering Development," was presented by M. B. Cooke of Alco Products Company. H. R. Swanson of the same concern was co-author of the paper. A review of trends during the past 18 months was presented in this paper. Cracking and treating methods had the most consideration.

H. R. Leland of General Metallizing Company, Tulsa, read a paper, "Latest Developments in Metallizing." Methods and results from applying metals, such as aluminum and lead, to cracking chambers and other equipment was described in detail.

R. R. Irwin, president of White Eagle Oil Corporation, Kansas City, presided and directed the discussion on each of these subjects.

The night session, April 5, was devoted to the general subject of lubricants. J. R. Mallory of the staff of the association outlined the progress of the bright stock group in 1933. General discussion followed.

A proposal that the number of lubricating oils and greases for automobiles be reduced came from L. C. Eldridge of the Shell Petroleum Corporation, St. Louis, in his paper, "Reduction in Number of Lubricating Oils and Greases and Resultant Benefits."

His position was that the petroleum industry has been forced into an unfor-

AGAIN HEADS WESTERN REFINERS

HOWARD BENNETTE

tunate position by accepting the demands of the automobile manufacturers.

"Manufacturers design bearings and then call for the proper lubricants. Only slight changes in design would allow but a few lubricants to take care of the needs of the automobile. Instead of taking what the automotive engineer designs, we should set up the lubricants best suited to our sales program and let the automotive engineers change bearings to fit the lubricants we have."

He said that three grades of lubricating oils would take care of crankcase requirements and that the number should be reduced to the fewest that will suffice.

The discussion was to the effect that the petroleum industry is not properly asserting itself in lubricants.

Wider use of oil in highway construction was the theme of the final session. Speakers outlined how it is possible to use oil for secondary highways and build five times as much mileage as can be built with concrete. The effect of more roads on gasoline was one benefit presented, while the oil thus used withdraws that much raw material from material available for gasoline manufacture.

First came the report on the road oil committee by L. H. Prichard of Anderson-Prichard Oil Corporation, Oklahoma City, chairman of the committee. He was followed by W. L. Harding, former governor of Iowa, whose interest in highway construction keeps him active in behalf of roads built with oil.

His suggestion was that the oil companies use part of their advertising space to educate the public on the possibilities of oil.

"In Iowa," he said, "some 500 miles of concrete highway will be built this year. Most of it will be placed on roads which would serve as well if built with oil and instead of 500 miles of highway there would be 2500 miles of highway. Those roads would pass the farms and go into the villages of the state. They would give the population of those areas, roads useable the whole year.

"It is for you to calculate what it would mean in increased gasoline consumption. But those people do not know that oil roads will serve them as well as concrete. So it is a job of education.

"Furthermore, there is a humanitarian phase to the question. No state can afford to build sufficient concrete highways for all its roads. The result is that the larger centers are being favored and the rural districts and smaller towns are neglected. The people are thus left at a disadvantage."

The annual meeting was used for an informal discussion of the marketing code. P. M. Miskell, regional chairman for the area, presided. This meeting brought many marketing executives as well as code members not connected with refining. Secretaries of the associations of jobbers in the Mid-Continent also attended.

Problems of natural gasoline distribution were presented by S. S. Smith of Shell Petroleum Corporation, Tulsa. He outlined the difficulties encountered in distributing natural gasoline because of its variation in use in keeping with seasonal requirements. When refiners are using lesser amounts of this material in motor fuel, the excessive supply finds its way into the retail market through jobbers. Its price at such seasons is low and it thus serves to pull down the price of gasoline at service stations.

It was decided to name a committee of refiners to work with a committee of the Natural Gasoline Association of America looking to a solution of the problem.

Officials of the Western Petroleum Refiners Association were elected as follows:

Howard Bennette, Tulsa, president; T. H. Barton, Lion Oil Refining Company, El Dorado, Arkansas; Roy B. Jones, Panhandle Refining Company, Wichita Falls; and C. L. Henderson, Vickers Petroleum Company, Wichita, Kansas, vice presidents.

The board of directors is: T. A. Helling, El Dorado Refining Company, El Dorado, Kansas; Alexander Fraser, Shell Petroleum Corporation, St. Louis; A. E. Landsittle, Globe Oil Refining Company, Wichita; C. M. Boggs, Kanotex Refining Company, Arkansas City; C. B. Watson, Pure Oil Company, Chicago; D. P. Hamilton, Root Refining Company, Shreveport; E. S. Karstedt, Continental Oil Company, Ponca City; H. A. Trower, Phillips Petroleum Company, Bartlesville; L. B. Simmons, Rock Island Refining Company, Duncan; Rex H. Winget, Cushing Refining & Gasoline Company, Cushing; A. L. Derby, Derby Oil Company, Wichita; R. R. Irwin, White Eagle Oil Corporation, Kansas City; Sheldon Clark, Sinclair Refining Company, Chicago; W. G. Skelly, Skelly Oil Company, Tulsa; D. W. Harris, Louisiana Oil Refining Corporation, Shreveport; L. H. Prichard, Anderson-Prichard Oil Corporation; L. B. McCammon, Marathon Oil Company, Tulsa; R. W. McDowell, Mid-Continent Petroleum Corporation, Tulsa; B. L. Majewski, Deep Rock Oil Corporation, Chicago; B. H. Gray, Spartan Oil Corporation, Shreveport; D. C. Gray, Waggoner Refining Company, Electra.

Past presidents of the association also are directors as follows: P. M. Miskell, Empire Oil & Refining Company; Roy B. Jones, Panhandle Refining Company, Wichita Falls; L. R. Crawford, Producers & Refiners Corporation, Independence; George D. Locke, Barnsdall Refineries, Inc., Chicago.

More Gasoline Allowed in April by Federal Board

A SLIGHT increase in the allowable production of gasoline for April became effective April 1, according to announcement by Secretary of the Interior Ickes, Oil Administrator. April production was fixed at 31,910,000 barrels as compared with 31,791,000 barrels for March. The increase was authorized to meet the increased consumptive demand brought about by the arrival of spring. The administrator's order provides that the allowable gasoline production in the refining districts shall be allotted to the refineries by the Planning and Co-ordination Committee, subject to approval of the administrator.

The order reads: "The gasoline production (at refineries including straight run, cracked and natural gasoline blended) in each of the various refining districts for the month of April, 1934, shall not exceed the following: East Coast, 5,500,000; Appalachian, 1,475,000; Indiana-Illinois, Kentucky, 4,890,000; Oklahoma, Kansas, Missouri, 4,400,000; Texas, inland, 2,555,000; Texas Gulf Coast, 5,300,000; Louisiana Gulf Coast, including Alabama, 1,100,000; North Louisiana, Arkansas, including Mississippi, 900,000; Rocky Mountain, 660,000, and California, 5,130,000—all in barrels of 42 gallons."

About the same time Administrator Ickes set the national allowable for crude oil production for April and May at 2,366,200 barrels daily, an increase of 83,400 barrels over the March allowable of 2,282,200 barrels. This increase was likewise authorized to meet the usual increased seasonal demand brought on by the advent of spring. Each of the 18 oil producing states was allowed a larger production, the largest increase, 32,800 barrels, going to Texas, the largest producing area, and the second largest to Oklahoma, which was given an increase of 20,000 barrels. The allowable for California was increased by 8600 barrels, and Kansas 9800 barrels. Other states were given relatively smaller increases.

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SCIENCE AND TECHNOLOGY

Abstracts prepared in co-operation with the

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by

THE LESLIE LABORATORIES

Traver Road, Ann Arbor, Mich.

under the supervision of

DR. E. H. LESLIE and DR. H. B. COATS

The abstracts here presented are selected from the current literature of science and technology to afford reference to fundamental information not easily available to all readers. Abstracts of articles appearing in readily obtainable trade journals are not included.

Photostat copies of original articles will be supplied at cost by the Leslie Laboratories. Complete or limited bibliographies covering special topics by title, by abstract, or in complete manuscript, will also be prepared and furnished at reasonable cost by the Laboratories.

Fundamental Physical Data

Phase Equilibria in Hydrocarbon Systems. II. B. H. SAGE, W. N. LACEY and J. G. SCHAAFSMA. *Ind. Eng. Chem.* **26** (1934) pp. 214-17.

As an approach to the problem of studying the behavior of systems of hydrocarbons, such as mixtures of petroleum and natural gas below ground, the investigators deemed the study of simpler systems advisable. Accordingly, the methane-propane system was studied throughout the temperature and pressure ranges commonly found in under-ground petroleum formations. This system can be considered as illustrating the behavior at least in a simplified manner of natural gas in contact with high-gravity, volatile oil. Equilibria data are presented along with diagrams prepared therefrom.

Chemical Composition and Reactions

Synthesis of Hydrocarbons of High Molecular Weight. M. LERER. *Ann. des Comb. Liq.* **8** (1933) pp. 681-733.

Hydrocarbons of complex structure, both aromatic and aliphatic, have been synthesized and their properties determined. Viscosity curves have been determined as part of a general investigation of the relation between viscosity and structure. Alkyl anthracene compounds have been made and found to be very viscous liquids at ordinary temperature. However, the viscosity falls sharply on heating. Naphthalene derivatives of similar nature have also been prepared. Branched chain olefines and paraffins containing up to 48 carbon atoms have been made starting from octyl alcohol. These liquids have much lower viscosities than the cyclic compounds previously mentioned.

Pyrolysis of Saturated Hydrocarbons. F. E. FREY. *Ind. Eng. Chem.* **26** (1934) pp. 198-203.

The literature of the thermal reaction of hydrocarbons with special attention to the primary decomposition reaction is reviewed. The paraffins decompose chiefly into simpler olefins and paraffins. High temperature favors the concomitant formation of complementary olefins and hydrogen, and in some instances more than two hydrocarbon product molecules are formed. The primary decomposition of the cyclo-paraffins has not been investigated extensively. In dehydrogenation catalysis is a factor. The paraffins are dehydrogenated to the corresponding olefins, or degraded to carbon, methane, and hydrogen. The Cyclo-hexane compounds are converted to the corresponding aromatic compounds. The other cyclo-paraffin hydrocarbons enter into various molecular re-arrangements.

Kinetics of Ethylene Polymerization. H. H. STORCH. *Jour. Am. Chem. Soc.* **56** (1934) pp. 374-8.

Data are presented that show the composition and amount of product obtained from polymerizing ethylene at 377° C. and 1415 mm. mercury. The data indicates that the primary product is butylene and that propylene formation is secondary. Minute amounts of oxygen accelerate the reaction. There is also a large increase in reaction rate with time of contact. In the temperature interval of 350° to 400° C. the heat of activation was found to be 42,000 calories.

Kinetics of the Thermal Isomerization of Cyclopropane. T. S. CHAMBERS and G. B. KISTIAKOWSKY. *Jour. Am. Chem. Soc.* **56** (1934) pp. 399-405.

The thermal transformation of cyclopropane to propylene has been studied in a static system and found to be homogeneous and uni-molecular. The rate constants are dependent on the pressure of the reacting system. An equation is given for the high pressure constant. To account theoretically for the dependence of rate on the pressure on the basis of classical localized energy theories of uni-molecular reactions it was necessary to assume 25 squared terms in the energy function of the molecule.

Thermal Decomposition of Propyl Mercaptan. H AUSTIN TAYLOR *and* EDWIN T LAYNG. *J. Chem. Physics* 1 1933) pp. 798-808.

The thermal decomposition of propyl mercaptan at temperatures of 405-35° C. and at pressures of 100-300 mm. was studied both by static and dynamic methods. There is an induction period with an auto-accelerating rate and ending in an apparent equilibrium of propylene, H_2S, and propyl mercaptan. The energies of activation of the reactions are given. A mechanism for the reaction is proposed, and the vapor pressure of propyl mercaptan is given and expressed as an equation.

Destructive Hydrogenation of Petroleum Hydrocarbons. W. J. SWEENEY and A. VOORHIES, JR. *Ind. Eng. Chem.* 26 (1934) pp. 195-8.

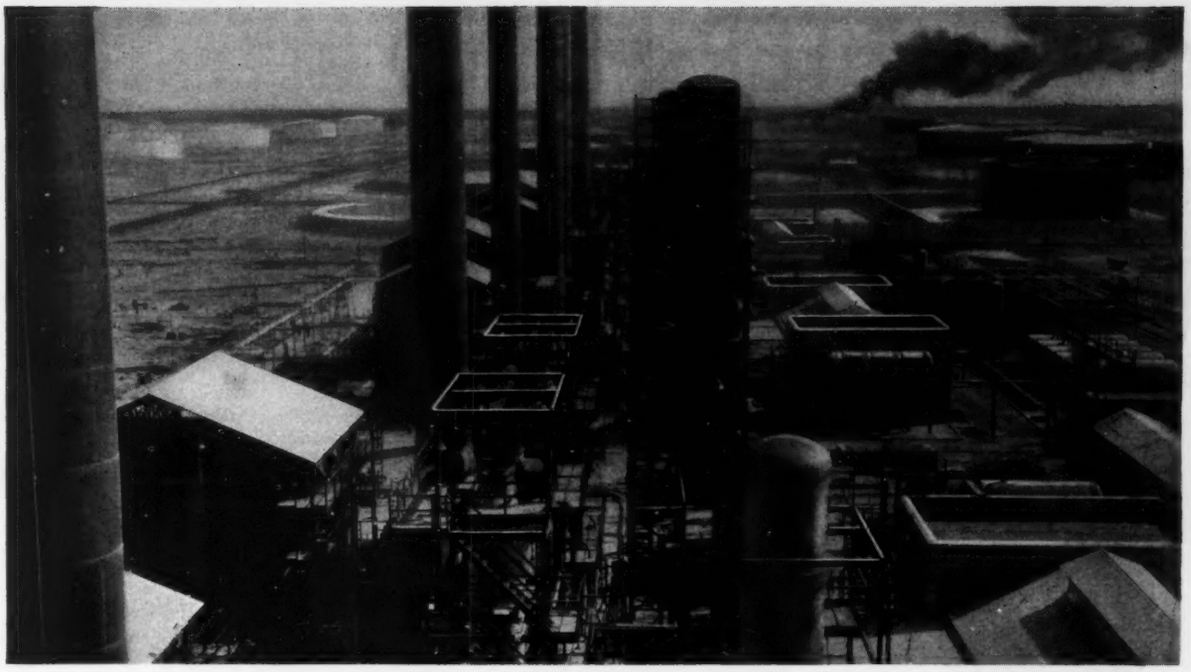
The catalytic hydrogenation of petroleum oils is discussed in the light of thermodynamic data for pure hydrocarbons. Reactions of simple hydrogenation and reactions including cracking and hydrogenation are interpreted with the aid of free energy relations. Equations derived are graphically presented and show the effect of hydrogen pressure and of reaction temperatures in both simple and destructive hydrogenation. Destructive hydrogenation and cracking are compared, particularly in regard to gasoline yields. The hydrogen content of fresh, cracked, and hydrogenated petroleum fractions is presented graphically as a function of boiling points and gravity. In recent experiments on the hydrogenation of petroleum oils a yield of over 115 percent of stable gasoline was obtained from refractory, hydrogen deficient gas oil.

Decomposition of Saturated Hydrocarbons under Oxidizing Conditions at Low Temperatures. A. W. BURWELL. *Ind. Eng. Chem.* **26** (1934) pp. 204-7.

The liquid-phase oxidation of hydrocarbons from various petroleum sources and under controlled conditions of temperature and pressure is discussed. Oxidation was usually by means of air and the temperature was maintained considerably below the decomposition temperature of the hydrocarbon oxidized. From a study of the products the reactions involved are suggested. Oxidation reactions at the cracking temperature are discussed briefly, and also oxidation reactions involving ozone or other oxygen addition compounds are briefly considered.

Catalytic Vapor-Phase Hydration of Ethylene. F. J. SANDERS and B. F. DODGE. *Ind. Eng. Chem.* **26** (1934) pp. 208-14.

Ethylene and other olefins are available in refinery gases and are important raw materials. The vapor-phase hydration of ethylene was studied both theoretically and experimentally over a range of temperature and pressure using alumina and tungstic oxide catalyst. The yield of ethanol was small, but was nevertheless significant. At 135 atmospheres pressure ethylene polymerizes extensively, but this was largely prevented by lowering the pressure to 70 atmospheres. By working at low velocity and in some instances by adding ethanol to the reacting gases an approximate value of 1.0×10^{-3} was obtained for the equilibrium constant at



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380° C. Some conclusions as to the maximum possible yield of ethanol that can be obtained under various conditions of pressure, temperature, and concentration of reactants are presented.

Manufacture: Processes and Plant

Heat Transfer for Fluids in Turbulent Flow in Pipes. R. CHANDLER. *Jour. Inst. Pet. Tech.* **20** (1934) pp. 51-72.

The author reviews the work of numerous investigators on the subject of heat transfer to fluids in turbulent flow in pipes. He notes that several equations have been developed from time to time purporting to apply, and that such equations when used within the range of variables supported by experimental data are often reliable, but that the majority of them contain more factors than have been experimentally investigated. The context as presented is too detailed and mathematical to lend itself to brief review.

Development of the Oil Cracking Art. P. C. KEITH and W. B. MONTGOMERY. *Ind. Eng. Chem.* **26** (1934) pp. 190-4.

The authors review the development of the cracking art, including the processes of Burton, Hall, Dubbs, Cross, and others such as Holmes-Manley, Gyro, DeFlorez, and Tube & Tank. Early processes were limited by the nature of available construction materials and methods of fabrication. Improvements in these respects and recognition of the governing factors have made possible the modern plants that operate successfully for long periods on any charging stock from naphtha to heavy residuum. Flow sheets on the various processes are given.

Fundamental Variables in Mixed-Phase Cracking. H. SNYDOR. *Ind. Eng. Chem.* **26** (1934) pp. 184-7.

The author describes the effect of time, temperature and pressure on the yield and characteristics of the products secured in cracking. A diagram of a modern Tube & Tank unit is given and the cracking coil cycle is described in detail. The effect of the amount of recycling on product yields is discussed. Experimental data are given to show the dual and progressive nature of the reaction. The difficulty of orienting the effect of the several variables is emphasized, but the results of a series of experiments to study the effect of individual variables is given. Temperature and the extent of conversion per pass are shown to be more important than pressure in their effect on the yields and characteristics of the products secured.

Vapor-Phase Cracking. C. R. WAGNER. *Ind. Eng. Chem.* **26** (1934) pp. 188-9.

The author distinguishes two types of vapor-phase cracking operation. First, high pressure operation at temperature from 950° to 1050° F., and, second, low pressure operation at temperatures in excess of 1050° F. Part of the difference in result secured by these two types of processes is explained by the polymerization of the simpler olefins. Tubular data are given and are of interest in comparing the two types of vapor-phase processes.

Hydrogenated Lubricating Oils. R. KOBAYASHI. *J. Fuel Soc. Japan* **12** (1933) pp. 118-120.

The author notes that hydrogenation in America is effected at 450° C. and 200 atmospheres. The most suitable catalytic agent has been iron promoted with a mixture of tung-

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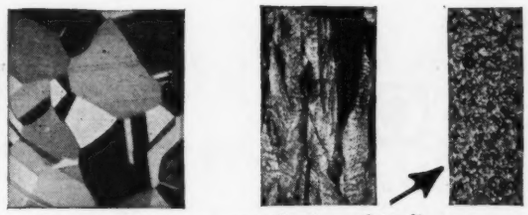
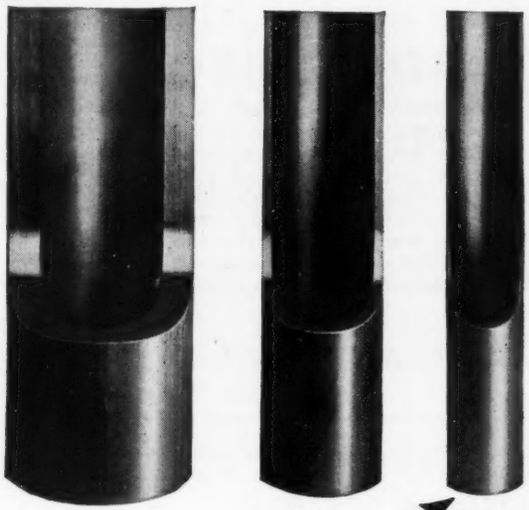


Micrographs show magnification of 50 diameters

EXTRUDED ROLLED *then* DRAWN . .



NOTE THE SMOOTH, CLEAN SURFACES

Fig. 1 Fig. 2 Fig. 3

Fig. 1 shows tube as extruded. Note smooth interior surface. The micrograph above reveals the grain structure. ¶ Fig. 2 shows same tube after being cold rolled. While the smooth inside surface is retained, cold working completely changes the grain structure throughout the cross section of tube as the micrograph indicates. ¶ Fig. 3 shows tube after drawing and annealing. Note smooth, clean, inside and outside surfaces; also the further complete change in structure to the small grain size so essential to satisfactory condenser tube installations.

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sten and molybdenum oxides or sulphides. However, the author claims that the mixed oxides or hydroxides of nickel and copper act as effective catalysts in hydrogenating lubricating oils at 150° C. and 30 atmospheres, and that they possess practical advantages over iron catalysts. The principal advantage is the lower temperature at which hydrogenation is effected. The velocity of hydrogenation and the characteristics of the product are better than with iron catalysts. It is advantageous, for example, to hydrogenate crude turbine oil at 150° C. or lower temperature since higher temperatures tend to destroy the main constituents. For the making of high grade machine lubricants it is proposed to hydrogenate at lower temperature and pressure, wash the hydrogenated product with sulphuric acid, and complete purification by contact filtration with acid clay.

Modern Methods of Refining Lubricating Oils by Solvent Extraction. K. FURST. *Petroleum* **29** (1933) No. 44; Motorenbetr. **6** pp. 2-6.

The requisite properties of suitable solvents for the refining of lubricating oils are discussed, and an account is given of the results that have recently been obtained in the technical application of liquid sulphur dioxide and benzene, nitrobenzene, phenol and chlorex. The use of these solvents effects a marked rise in the viscosity index of the oil, and lowers the Conradson carbon residue. Other physical characteristics are also improved.

Sulphonic Acids Formed in Refining of Mineral Oils. R. FUSSSTEIG. *Chim. et Ind.* **30** (1933) pp. 1027-1033.

Oil soluble sulphonic acids that are extracted from the oil by aqueous caustic soda and are precipitated with acid still contain neutral oil that can be removed by extraction of an alkaline aqueous solution with acetone or ether. The acid so recovered is strongly foaming aqueous solutions and are saturated towards bromine in carbon tetrachloride. Asphaltenes can be extracted from the acid tar that comprises the oil insoluble products of acid refining, are dried, freed from carbonaceous matter by extraction with benzene, evaporated and re-extracted with light petroleum ether. The final extract yields water-insoluble salts from which high molecular weight sulphonic acid can be precipitated. The soluble calcium salts extracted from the acid tar by neutralization with calcium hydroxide and filtration from calcium sulphate are not homogeneous but give a mixture of water-soluble and insoluble salts with strontium, barium, lead, silver, and other metals.

Natural Gas and Natural Gasoline

Twenty-five Years of Natural and Refinery Gases. G. A. BURRELL. *Ind. Eng. Chem.* **26** (1934) pp. 143-50.

A statistical review of the production and use of natural gas is given. The development of methods of analysis is briefly described. The subject of gas transmission is briefly reviewed. Methods of purifying natural gas of hydrogen sulphide, of removing water vapor, or of saturating the gas with water and oil vapor are reviewed. The recovery of gasoline from natural gas is reviewed historically and flow sheets are given of modern plants of the several types. The carbon black industry is briefly described as well as the reforming of natural gas and the making of by-products from natural gas. Brief reference is made to the utilization of refinery gases.

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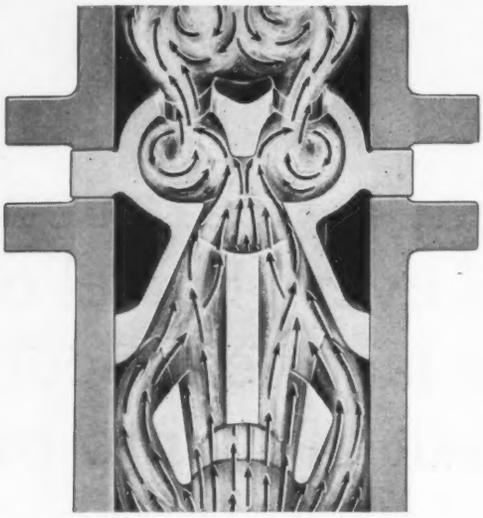

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Products: Properties and Utilization

Lubricants for Metal Working. *Chem. Trade J.*, **93** (1933) p. 211.

The lubrication of machinery used in metal working presents several difficulties, not the least of which is the corrosive action of many lubricants that have been used. Fatty oils have now been largely replaced by lubricants having a mineral oil base. Mineralized colza is one of the best in the fatty oil class. Sulphurized mineral oils and lead soap mixtures have recently been introduced for metal drawing. The use of ordinary machine oils and cutting oils is not recommended for metal working. Leading manufacturers of proprietary lubricants are carrying on systematic research directed towards finding the best lubricant for the different kinds of metal working and for the different metals or alloys worked.

Carburetting Oils: Examination and Evaluation. P. SCHLAPFER and S. SCHAFFHAUSER. *Gas J.* **203** (1933) p. 676 (from Monatsbulletin des Schweiz Vereins von Gas und Wasserfachmannen **13** (1933) pp. 125-143).

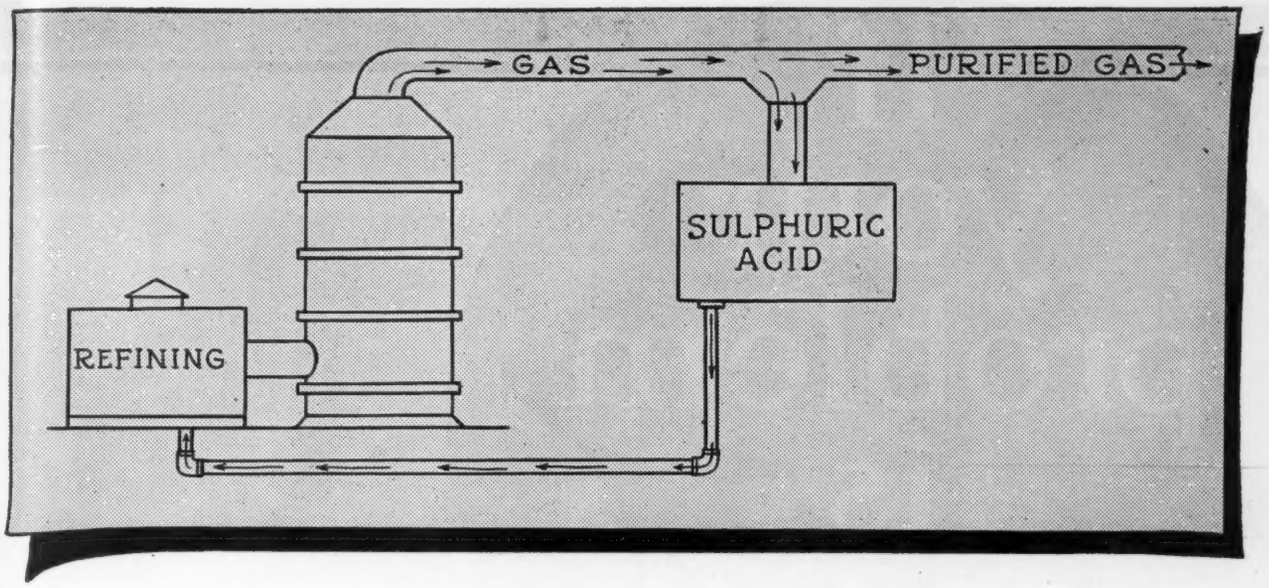
An investigation of gas oils for the enrichment of water gas was made in order to ascertain whether it is possible to determine the carburetting value of a gas oil from its physical and chemical properties. The effects of temperature, rate of oil admission, and hydrogen were studied. When temperature is increased and oil rate is constant the gas production as B.T.U. per pound of oil increases in the region of 650-800° C., but the calorific value of the cracking products decreases. At constant temperature but increasing rate of oil admission the gas yield falls, but the calorific value increases. Results obtained on using different types of gas oils are given. When oil is introduced at constant rate into different amounts of hydrogen of different temperatures it is found that the main reaction of the hydrogen is its fixation by the products of cracking, and also the calorific value of the gaseous hydrocarbons increases by 90 to 225 B.T.U. per cubic foot. It is concluded that the carburetting value of an oil does depend on physical and chemical properties of the oil, and that gas oils containing 50 percent or more of components boiling below 300° C. are not suitable for use. Reference is made to the carburetting index proposed by Holmes and another similar expression is proposed that is deemed even better than the Holmes index.

Anomalies in the Viscosity of Mineral Oils at Low Temperatures. LOUIS, JORDACHESCU *and* THIEBAULT. *Physics* **4** (1933) pp. 401-2.

Viscosity measurements at low temperatures show that after the change in temperature an oil may require several weeks to attain an equilibrium state. Oils show no yield value since they flow under the slightest pressure.

Critical Study of the Determination of Ethane by Combustion Over Platinum in the Presence of Excess Oxygen. MARTIN SHEPHERD and JOSEPH R. BRANHAM. *Bur. Stand. J. Research* **11** (1933) pp. 783-97 (Research Paper No. 625).

Ethane was burned by slow combustion over glowing platinum in the presence of oxygen. The contraction in volume, the volume of carbon dioxide produced, and the volume of oxygen consumed were measured. The values found for the first and last were invariably too high, and those for carbon dioxide formed too low.



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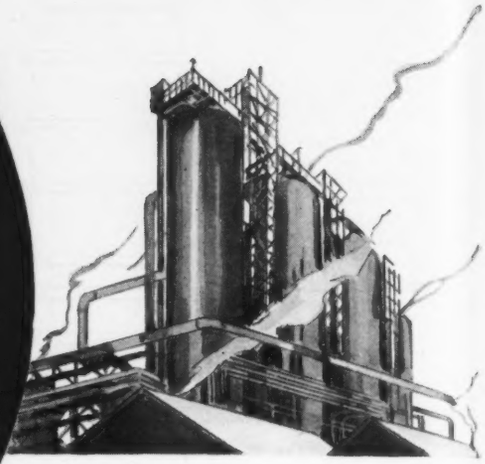

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You can get these pipe and tubes in a wide range of diameters, wall-thicknesses, and lengths. They can be readily bent, welded, and otherwise fabricated. NATIONAL engineers and metallurgists are at your command to determine the best application for any particular requirement. Descriptive literature on request.

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THE MONTH IN REVIEW

A. S. T. M. Committee D-2 on Petroleum Products and Lubricants

MEETINGS of Committee D-2 on Petroleum Products and Lubricants and its subordinate groups held during A.S.T.M. Committee Week in Washington, March 5-9 were events of considerable commercial as well as industrial interest. Both the meetings and subjects considered were numerous and it is evident that an increasing amount of work confronts the committee.

Among the highlights of the D-2 meetings interest in gasoline was conspicuous. Technical Committee A on Gasoline received an interesting report from its newly formed Section on Specifications. The immediate objective is "To determine the significance of the specification items for gasoline with reference to its performance in automotive engines (other than aircraft engines) and to indicate the economic factors involved in the formulation of gasoline specifications." Such information will serve as a guide in three matters, namely, (a) specification writing; (b) engine design; (c) gasoline manufacture. Progressive changes in engines and fuels impose a temporary significance on reports on this subject so that yearly revisions are expected and planned.

The subject of vapor locking characteristics of gasoline led to a spirited discussion. This will be continued in June at the annual meeting of the society.

The cloud and pour point test (D 97-30) will be subject to tentative revision along lines which clarify the procedure of conducting the tests and reduce operating discretion, but without altering previous results. For example, instead of referring to "a cooling bath of suitable temperature" the tentative revision provides a series of baths of specified temperatures.

A special subcommittee working on volume correction tables has nearly completed its work. It is safe to predict that the Standard Abridged Volume Correction Tables (D 206-25) and the corresponding U. S. Bureau of Standards Circular No. 154, National Standard Petroleum Oil Tables, will be revised at an early date to include two additional groups namely a "Group C" for products of A.P.I. gravity below 15° where the coefficient of expansion will be 0.00035 and a "Group VII," 94° to 100° A.P.I. gravity, coefficient of expansion 0.00090.

As a result of cooperative work between Committees D-2 and D-15 on Thermometers and Laboratory Glassware, specifications for certain glass apparatus have been modified slightly to improve accuracy and to simplify manufacture.

Technical Committee C on Fuel Oils formulated recommendations for changes in the present Commercial Standard Specifications for Fuel Oil to be referred to letter ballot of the committee.

A new subcommittee of Committee D-2 was organized to handle all matters pertaining to viscosity of petroleum, including viscosity-temperature relationships. Some consideration was given to expressing viscosity in absolute units as well as in Saybolt seconds. Pending the obtaining of additional desired information, action was deferred because this matter is of international significance.

Officers of Committee D-2 on Petroleum Products and Lubricants are, chairman: T. A. Boyd, Fuel Section, Research Laboratories, General Motors Corporation; secretary: R. P. Anderson, secretary, Division of Refining, American Petroleum Institute.

Speakers Announced For N. P. A. Program

AT the annual spring meeting of the National Petroleum Association, Cleveland, April 19 and 20, a number of men prominent in the industry are scheduled to speak. In addition a number of group meetings will be held, at which members will discuss marketing problems, specifications of products and taxation.

At the general session during the afternoon of April 19 the following speakers will be heard: Charles L. Suhr, Pennzoil Company, and president of the association; Albert W. Atwood, editorial and financial writer for the Saturday Evening Post; J. Howard Marshall, member of the Petroleum Administrative Board, and C. E. Arnott, president of the Socony-Vacuum Corporation and member of the Planning and Coordination Committee.

At the general session on the morning of April 20 the following will speak: H. C. Mougey, chief chemist, General Motors Research Corporation; P. G. Johnson, president, United Aircraft & Transport Corporation; J. B. Fisher, Kendall Refining Company; Willis Crane, associate counsel, National Petroleum Association, and W. T. Holiday, president, Standard Oil Company of Ohio and also a member of the Planning and Coordination Committee.

A group conference on the evening of April 18 will discuss Pennsylvania gasoline. On the morning of April 19 there will be group conferences on Pennsylvania lubricants; Mid-Continent lubricants; and proposed regulations of the Bureau of Internal Revenue on taxes. A conference of members of the Planning and Coordination Committee's sub-committees for the eastern and central states is also planned.

The annual fellowship supper will be held at the Hermit Club, with entertainment, on the evening of April 19.

Program for Gas Measurement Course

MANY technical problems are to be studied by those registering for the Southwestern Gas Measurement Short Course, to be held at the University of Oklahoma, Norman, April 24, 25, 26. W. R. McLaughlin, Arkansas Natural Gas Corporation, chairman of the meter school committee, will preside over the general assemblies. E. F. McKay, manager of Oklahoma Utilities Association, will introduce Dr. Wm. B. Bizzell, president of the University of Oklahoma, who will deliver the address of welcome at the opening session. Talks will be made by Ray E. Miller, secretary of the Natural Gasoline Association of America, and A. E. Higgins, secretary of the Natural Gas Department of the American Gas Association. W. P. Z. German, general attorney, Skelly Oil Company, will also address the opening assembly.

At the remaining general sessions the following technical papers will be presented: Fundamental Gas Laws, by E. F. Dawson, university faculty; Fundamental Principles of Regulation, by J. C. Diehl, Metric Metal Works; Fundamental Principles of Orifice Meters, by W. W. Frymoyer, The Foxboro Company; Fundamental Principles of Positive Meters, by A. D. McLean, Pittsburgh Equitable Meter Company; College of Engineering and the Gas Measurement Short Course, by J. H. Felgar, Dean of the College of Engineering; D. A. Sillers, Lone Star Gas Company, will read a paper prepared by R. S. J. Pigott, chairman of Fluid Meters Committee of the American Society of Mechanical Engineers; a paper by J. J. Hassler, gas and electric engineer of the Oklahoma Corporation Commission; a paper by Professor W. H. Car-

son, Director of the School of Mechanical Engineering, and an address by R. W. Hendee, president, Oklahoma Natural Gas Company.

All types of meters, regulators, instruments, balances, gauges, controls and like equipment, will be on display in the equipment exhibition in the engineering building, where they will be studied by those in attendance and displayed and explained by sales engineers of the manufacturers.

More About Resins From Petroleum

RECENTLY there was announcement of a new company, Monsanto Petroleum Chemicals, Inc., formed as a controlled affiliate of Monsanto Chemical Company, Dayton, Ohio, to take over the plant and processes of Dayton Synthetic Chemicals, Inc. This company was formed about four years ago as a subsidiary of the Thomas & Hockwalt Laboratories, Inc., to exploit the manufacture and use of resins synthesized from petroleum.

Under the title "Synthetic Resins Now Made from Petroleum," A. D. Camp of Thomas & Hockwalt Laboratories, presented in Chemical & Metallurgical Engineering, Volume 41, No. 3, March, 1934, page 123, the following short discussion of these resins and their application:

"The synthetic resin derived from petroleum hydrocarbons, produced by Monsanto Petroleum Chemicals, is closely related to the gums, which have become such a nuisance to the producers of cracked petroleum gasolines. The problem of their production, however, has been the reverse of that of eliminating of gum formation in gasoline, since means have been sought to accelerate rather than retard the formation of the resinous material. The result of this research has led to the production of a new synthetic resin.

"The process of manufacture of petroleum resins consists in treating a cracked distillate containing hydrocarbons of varying degrees of unsaturation, such as olefins and diolefines, in the presence of a metallic halide catalyst under carefully controlled conditions. The reactions involved are many and complex, probably including the reaction of olefines to form oily polymers, reaction of olefines to produce substituted aromatics, polymerization of diolefines and olefines to resins and reaction of diolefines with substituted aromatics to form resins. By modifying the conditions of treatment, the properties of the resultant resins can be varied widely.

"One of the principal commercial uses of these resins has been in the paint and varnish industry. For example, a resin for varnish formulation may be produced having a light amber color. It is a hard brittle material having a melting point, by the ball and ring method, of 110-115° C. It is soluble in practically all hydrocarbon solvents, and insoluble in methanol, ethyl alcohol, and acetone. It also dissolves in the higher acetates, but not in ethyl acetate. The resin is readily soluble in drying oils such as linseed and china wood oil, and with the latter it makes varnishes which dry more rapidly than those made with any type of resin heretofore known. A varnish film of this composition has the tendency to bleach or become light upon drying, which facilitates the use of light-colored pigments without later turning yellow. The resin is practically neutral, having an acid value of 0.1 to 2. The iodine value can be varied to bring out unusual characteristics. When a film made by dissolving a highly unsaturated resin in petroleum spirits is baked for one hour at 105° C., the film becomes insoluble in its original solvents.

"In the molded plastics field, petroleum resins have been used to some extent by compounding them with certain fillers and plasticizers. Used alone with fillers, these resins are classed a high melting point thermoplastics, but when compounded with certain hardening agents, they take a permanent set during molding like the phenol-formaldehyde resins. They have been used for the fabrication of steering wheels, tool handles, electric fixtures, and many articles to which molding resin mixtures are now being applied."

Texas City Refinery Begins Operations

PAN AMERICAN Refining Corporation is making test runs at its new Texas City refinery. The large combination crude skimming and cracking unit now going into operation will process over 30,000 barrels of crude oil daily. This marks the beginning of operation of the only large refinery to be erected in the Gulf Coast area in recent years and its completion brings the refining capacity of the Texas Gulf Coast up to 567,500 barrels per day, and closely approaching the refining capacity of the East Coast district.

Pending completion of the first crude unit at Texas City, Humble Oil & Refining Company has been running 25,000 to 30,000 barrels of crude at Baytown daily for the Pan American Refining Corporation. This will be reduced but continued on a reduced scale until the Texas City plant reaches its projected capacity of 50,000 barrels.

The company has been storing crude in its new tank farm at Texas City and the old Vacuum Oil Company tank farm purchased last year, and it is reported that about 1,500,000 barrels of crude, mostly from East Texas, is in storage. Stanolind Oil & Gas Company supplies the new refinery with crude on contract.

Chemical Engineers to Visit Hydrogenation Plant

AT the time of the semi-annual meeting of the American Institute of Chemical Engineers to be held at the Waldorf-Astoria Hotel, New York, May 14-21, a number of unusually attractive entertainment features are planned. Members of the institute and registered guests have been proffered invitation by the Standard Oil Company of New Jersey to visit the hydrogenation plant at the Bayway, New Jersey, refinery. Arrangements have been made for a private steamer for the trip, leaving and returning from the Day Line pier at West 42nd Street. Following the institute banquet there will be an inspection trip of the radio broadcasting facilities of the Rockefeller Center. The air conditioning plant and modern sound and heat insulating equipment will prove of chemical engineering interest. A half-holiday with entertainment, dinner at dance is planned at the Westchester-Biltmore Country Club in Rye, New York.

Continental Refinery Superintendents Meet

SUPERINTENDENTS and engineers of the refining plants of Continental Oil Company held the fifth annual conference at headquarters in Ponca City the week ending March 31. A program on refinery methods and company affairs continued through the week.

Walter Miller, vice president in charge of manufacturing, directed the program. John Ward, with W. M. Kellogg Company, was a guest and delivered a paper. Wesley I. Nunn, advertising manager of the company, discussed the Conoco Travel Bureau and advertising methods of the year.

Those attending were Fred G. Fellows, superintendent, and E. O. Glover, resident engineer, Ponca City; J. W. Brown, superintendent, and W. G. Windsor, resident engineer, Baltimore; D. H. Hyler, superintendent, and E. A. Elledge, engineer, Wichita Falls, Texas; G. B. Bogart, superintendent, and George Smee, resident engineer, Florence, Colorado; C. R. Tillman, superintendent, and P. L. Rowdon, resident engineer, Glenrock, Wyoming; C. V. Coulson, superintendent, Farmington, N. M.; Charles Moran, superintendent, Artesia, New Mexico; J. E. Fenex, superintendent, and R. E. Overton, mechanical engineer, Denver; H. H. Kinnaird, superintendent, Albuquerque, New Mexico; L. L. Smith, superintendent, Lewiston, Montana; Fred S. Nesmith, superintendent of the clay plant at Riverside, Texas.

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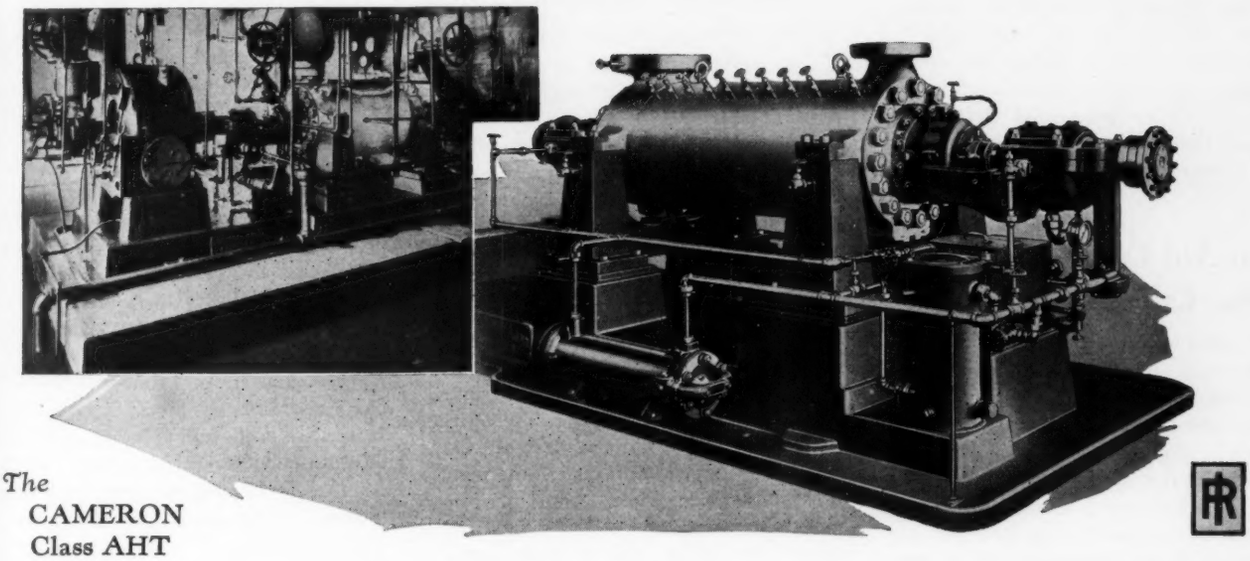

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Cameron Charging Pumps are available in ratings to meet the requirements of modern refineries.

They reduce installation costs.

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Is ideal for bringing coil up to temperature when starting or taking coil off stream.

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14-10

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Refiners to Visit Gulf Plant in May

THE Gulf Refining Company has extended invitation to the members of the National Petroleum Association to inspect its refinery and laboratory at Pittsburgh, probably on either May 21 or 22, according to announcement by Willis Crane, associate counsel for the association. This inspection trip will constitute a joint meeting of the Department of Standards and Test and the Department of Manufacture of the association. The date will be determined to give an opportunity to members to not only visit the plant, but also to attend the meeting of the American Petroleum Institute, which will be held in Pittsburgh, that week. Last year this group was invited to inspect The Atlantic Refining Company plant at Philadelphia, and earlier, the Kendall Refining Company plant at Bradford, Pennsylvania.

First Aid Contest at Tulsa Exposition

AS usual a first aid contest will be held in connection with the International Petroleum Exposition and Congress in Tulsa, May 12 to 19. The executive committee of the exposition has designated the day of the meet, May 18, as Safety Day. G. O. Lockwood, Empire Companies, Bartlesville, is chairman of the committee in charge. In his announcement he stated that in 1930 at the exposition 25 oil companies entered teams in the contest. With the present number of 18,000 trained first aid men in the Mid-Continent territory, the meet should be larger this year.

P. E. Keegan, Shell Petroleum Corporation, Houston, is director of the meet. The committee consists of the following: executive, representing the Petroleum Safety Council, G. O. Lockwood; H. W. Richards, Mine Safety Appliance Company, Tulsa; R. S. Huffman, Oklahoma Natural Gas Corporation, Tulsa; A. A. Odell, Barnsdall Refineries, Inc., Tulsa; representing the American Petroleum Institute: R. E. Donavan, Standard Oil Company of California, San Francisco; P. E. Keegan; H. N. Blakeslee, American Petroleum Institute, Dallas; representing the International Petroleum Exposition: W. B. Way, general manager, Tulsa; at large: J. J. Delahide, E. D. Bullard Company, Houston.

Problems committee: H. N. Blakeslee; publicity, J. W. Savage, Mid-Continent Petroleum Corporation, Tulsa; Berle Swift, Barnsdall Refineries, Inc., Tulsa, and Hadley Meyers, Sinclair Prairie Oil & Gas Company, Tulsa. The judges are H. W. Richards and J. J. Delahide.

R. S. Huffman heads the banquet committee while the entertainment committee is headed by Carl H. Martin, Phillips Petroleum Company, Bartlesville. A. A. Odell is chairman of the finance and awards committee. John Woodford, Oklahoma Natural Gas Company, is chairman of the committee on equipment and transportation.

The first aid contest is held under the sponsorship of the Petroleum Safety Council, and the Department of Accident Prevention of the American Petroleum Institute.

Safety Exhibit and Contests Planned for Houston Show

THE extensive program being prepared on safety work for presentation at the Oil Equipment and Engineering Exposition which will be held in the Convention Hall here April 16-21, is rapidly being whipped into shape. This work will be performed under the direction of E. D. Bullard Company and by advice recently received from this company it will be even more complete than first planned.

The program wil cover three major features of safety work. The first is the display of safety and first aid equipment that is applicable to the petroleum industry. The second is the handling, during the exposition, of all the first aid cases which may occur. The third is the nightly presentation of a short program of first aid, traffic safety and other "safety" demonstrations which will be both practical and of a character to appeal to the general public.

The safety equipment will be furnished by the E. D. Bullard Company. H. C. Weigley of Houston, states that in regard to the activities of his company during the oil show "we will also cooperate with the Harris County Emergency Corps in providing first aid supplies to take care of actual emergencies which may arise during the course of the exposition. Trained men will be available for this purpose at all times."

The assistance and cooperation of two ambulance companies will also be available for demonstration work. In regard to the nightly safety programs, the following organizations will actively participate: Houston Police Department; Houston Fire Department; Houston Gas & Fuel Company and the Harris County Emergency Corps.

Plans are being made for a first aid contest among teams from the various oil companies, the Houston Gas & Fuel Company and others. These events are more than contests; they are highly educational in character and are interesting to visitors, especially from the oil fields, as well as to the contestants.

A. C. S. Division of Petroleum Chemistry

THE Division of Petroleum Chemistry of the American Chemical Society will hold a joint meeting with the Petroleum Group of the Twelfth Midwest Regional Meeting, Muehlbach Hotel, Kansas City, Missouri, May 3, 4 and 5. The group will present 14 papers on petroleum, and in addition the chemists will hear 28 papers presented in the inorganic and physical group, 17 in the organic and biochemical, 10 in the chemical education and seven in the paint chemistry group. Student inspection trips on Friday and Saturday are planned.

The petroleum group papers are as follows: "The Determination of the Viscosities of Blended Lubricating Oils from the Mean Molecular Weight of the Components of the Blend," by John I. Moore and H. L. Dunlap; "The Vapor-Liquid Equilibrium of Hydrocarbon Mixtures," by Harold L. Beatty and George Calingaert; "Chemically Controlled Acidation of Oil Wells," by Sherman W. Putman; "Surface Tension Changes on the Addition of E. P. Bases to Lubricating Oils," by C. J. Boner; "The Anti-Knock Value of Certain Light Hydrocarbons," by F. B. Neptune and H. M. Trimble; "A Continuous Laboratory Topping Apparatus," by Harry T. Rall and Harold M. Smith; "Entrainment in Oil Absorbers," by F. A. Ashraf, T. L. Cubbage and R. L. Huntington; "Apparatus and Methods for Precise Fractional Distillation Analysis, Part VI—A Natural and Refinery Gas Analysis," by Walter J. Podbielniak; "Producing and Refining of Petroleum," by C. E. Ripple; "The Color Stabilization of Gasoline," by L. V. Sorg; "The Vapor-Phase Clay Treatment of Cracked Gasoline," by H. M. Steininger; "A Pure Hydrocarbon Standard for Evaluating Inhibitors," by C. G. Dryer, C. D. Lowry, Jr., J. C. Morrel and Gustav Egloff; "Manufacture of Penetration Asphalt from Petroleum by Vacuum Distillation," by Sidney Born; "Gasoline from Catalytic Treatment of Cracked Gases," by W. N. Ipatieff; "Heat Transfer Coefficient of Hydrocarbon Condensing Films," by Chas. L. Nickells.

New Chemical Engineer's Handbook

THE first edition of Chemical Engineers' Handbook, just published is designed to supply both practical engineers and students with authoritative reference data, and this handbook covers the field of chemical engineering and important related fields in a most thorough manner. The new work was compiled under the editorship of John H. Perry, physical chemist and chemical engineer

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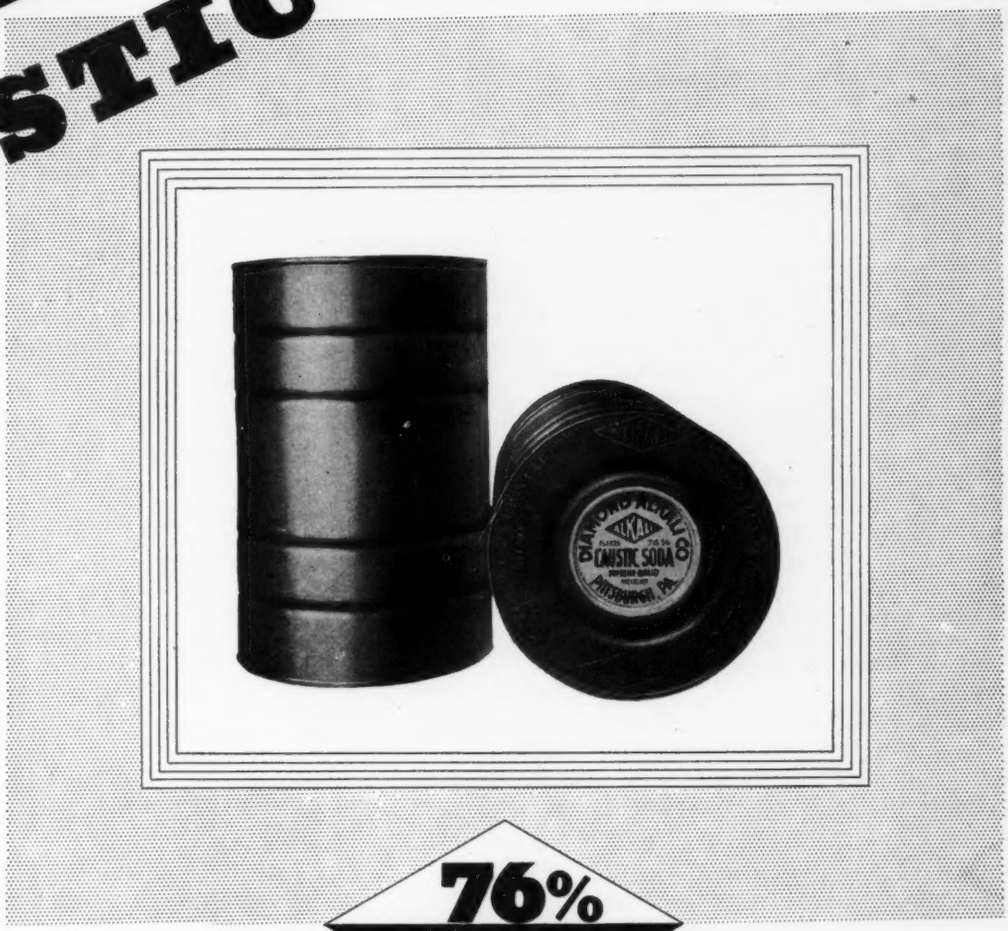

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for E. I. du Pont de Nemours Company, and represents the actual work of over 60 specialists who were assisted by 150 engineers and chemists.

The 2600 pages are arranged in 30 sections on as many subjects, encompassing each major division of unit operations for the process industries and the underlying physical, chemical, and mathematical aspects. Sections of particular interest include: Mathematical Tables and Weights and Measures, Mathematics, Physical and Chemical Data, Physical and Chemical Principles, Flow of Fluids, Heat Transmission, Evaporation, Humidification, Dehumidification, and Cooling Towers and Spray Ponds, Gas Absorption, Adsorption, Distillation, Drying, Crushing, Grinding and Pulverizing, Measurement and Control Process Variables, Materials of Construction, High-Pressure Technique, Movement and Storage of Materials, Fuels, Power Generation and Mechanical Power Transmission, Refrigeration, Electricity and Electrical Engineering, Accounting and Cost Finding, Safety and Fire Protection, Reports and Report Writing, Patents and Patent Law.

Any consideration of the foregoing headings indicates the monumental nature of the work. Throughout, the work is excellently presented and carefully done by men who are acknowledged leaders in their specialties. The handbook should find a highly useful place in the library of the practicing engineer, chemist, or technologist faced with chemical and engineering problems.

Copies of The Chemical Engineer's Handbook can be secured through the book department of The Gulf Publishing Company, Houston, Texas. Price $9.

Washing The Dog

THE chemist and petroleum inspector in the refinery laboratory gets many problems in addition to his chemical treating, corrosion, end points, viscosity, and other every day worries and troubles. He may confer with others on the plant on matters such as fermentation of malt syrups, un-stopping the kitchen sink, delousing the poultry or the analysis of local moonshine, but not often does he have the pleasant opportunity of deasphaltizing a pedigreed bird dog. Through the courtesy of The Lamp, house organ of the Standard Oil Company of New Jersey, where it appeared under the title "A Corporation and a Dog," the following is reprinted:

"During the early February cold snap the attention of a group of CWA workmen, employed near the railroad tracks at Parkersburg, W. Va., was attracted by a faint whimper.

"Investigating, they discovered a dog completely frozen in a cake of asphalt in a sewer trap, with only its nose and eyes protruding. Their first impulse was to put the animal out of its misery, but the dog's pleading eyes moved the men to try to save him.

"Crowbars were obtained, and the mass of asphalt encasing the animal pried loose from the main cake. Recalling that the Standard Oil Company made asphalt, someone called up the local refinery and was told to bring the dog over to the laboratory.

"Various oils were experimented with in an attempt to dissolve the asphalt without harming the animal. Finally, after several hours' continuous soaking in kerosene, followed by a series of soap and water baths, the dog—apparently a thoroughbred pointer—emerged from his strange prison, apparently none the worse. He was fed and permitted to lie in front of the fire to dry out while the management hunted for his owner.

"As far as local employes could reconstruct the scene, the dog had been trotting along the railroad tracks when he fell into a deep sewer trap. Asphalt draining out of nearby tank cars and running into the sewer apparently trapped the helpless animal as freezing temperatures congealed the mass into a solid block. He was near death when the civil works employes found him. His acquaintance with petroleum was short but poignant."

Tackling a Big Safety Program

"A NEW gasoline plant is being constructed in the north end of the East Texas field. In the construction of this plant and the field work in connection with it, approximately 700 men will work from four to six months. It is the avowed intention of the gasoline department and of all supervisors connected with this project to build this plant without a disabling or lost-time injury. While the accomplishment of such an undertaking cannot be said to be impossible, experience would indicate that it is highly improbable. Nevertheless, success comes only to those who try and progress is only a descriptive word for doing something new. The construction gang is out for success in their newest venture and positive progress in accident prevention work.

"Mr. W. W. Baker, vice president in charge of the gasoline department, Sinclair Refining Company, announces that the company will give a barbecue picnic to all men participating in the construction of this plant if the job has been done without a disabling injury. The celebration will be held the day the plant is ready for operation. Just how many steers will be needed to feed the gang is a matter of conjecture and remains a problem to be dealt with later.

"It takes nerve to tackle such a large order as building a major plant without disabilities, and it will take safety (and oodles of it) to fill that order. Here's hoping disappointment and injury do not mar the undertaking.—Sinclair Safety Service."

(Note: The foregoing was "lifted" bodily from the March issue of the News Letter of the Petroleum Section, National Safety Council, and to G. O. Lockwood, The Empire Companies, Bartlesville, editor, thanks.)

New Officers Elected For Oil Association

AT the annual meeting of the Louisiana-Arkansas Division of the Mid-Continent Oil & Gas Association, the following officers were elected for the ensuing year: J. R. Crawford, Shreveport, president; D. W. Harris, Arkansas Natural Gas Corporation, Shreveport, vice president; J. S. Hasson, Ohio Oil Company, Shreveport, vice president; R. L. Gay, Zwolle, Louisiana, vice president; M. W. Grimm, Shreveport, vice president; R. F. Sebastian, Shreveport, treasurer and Joseph E. Elam, Shreveport, secretary. All were reelections excepting M. W. Grimm, who succeeded James H. Dugan of El Dorado, Arkansas.

Cayuga Crude Analysis

CRUDE oil from the Cayuga field, northwestern Anderson County, Texas, now under development, coming from the Woodbine formation, is reported to yield from 33 to 36.0 percent gasoline of relatively low octane rating. One analysis indicates 28.9 A.P.I. gravity, .4 percent BS&W, 1.8 percent sulphur. The gasoline yield was 36.5 percent, the next fraction being 30 percent gas oil and 32 percent residue. Crude from the first well is being run through The Texas Company pipe line along with oil from East Texas. The Texas Company is paying Mid-Continent price, gravity basis, or 79 to 81 cents per barrel.

Technical Translations

THE Bureau of Russian Technical Translations has been formed by a group of Russian engineers residing in St. Louis. This organization has as its purpose the handling of scientific, mechanical, electrical and chemical, translations from foreign literature, including French, German, Spanish as well as Russian. The staff of the organization consists of N. P. Boorzhinsky, civil and electrical engineer; A. F. Bucholtz, biologist; Eugene V. Nay, chemist; C. N. Neklutin, mechanical engineer; V. P. Netchvolodoff, consulting engineer; V. V. Netchvolodoff, mechanical and industrial engineer, and

BOOKS ON PETROLEUM AND REFINING

HEAT TRANSMISSION—*William H. McAdams.*

A comprehensive treatise sponsored by the Committee on Heat Transmission, National Research Council, dealing with the various fields of heat transmission, based on considerable unpublished data as well as on a critical examination of the literature. Contains authoritative correlations for the various important cases of heat transfer with 33 examples of the application of the recommended relations. Published January, 1933. Price, $5.00.

CHEMISTRY AND TECHNOLOGY OF CRACKING—*A. N. Sachanen and M. D. Tilicheyev.*

Published in December, 1932, this book is a valuable addition to the library of those interested in cracking unit design, construction, or operation, or in the general subject of the chemistry or cracking. This late work covers thoroughly the fundamental features of cracking, chemistry of cracking, chemical composition of cracked products, properties and chemical treatment, the principle cracking systems, and includes an excellent chapter on the hydrogenation of petroleum products.

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BUTANE - PROPANE HANDBOOK — *Arranged and Edited By Geo. H. Finley, Editor Western Gas.*

The first edition of the Butane-Propane Handbook, published November, 1932, is the only work of its type and presents a most thorough treatment of the liquefied petroleum gases industry. Contents: A Chronology of Liquid Gas Development, Physical Properties of the Liquefied Petroleum Gases, Properties of Butane-Propane Mixtures and Relation of Properties to Temperatures, Composition and Analytical Determination of Liquefied Petroleum Gases, The Manufacture of Liquefied Petroleum Gases, Transportation of Liquefied Petroleum Gases, The Use of Butane and Propane with Manufactured Gas, Central Plants for Butane-Air Service, Central Plants for Undiluted Butane-Propane Vapor Service, Liquefied Petroleum Gases as Industrial Fuels, Appliance Utilization of Liquefied Petroleum Gases and Bottled Gas Distribution of Liquefied Petroleum Gases.

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This is American Chemical Society Monograph No. 63, and is a notable contribution to the literature on modern chemical treating practice, covering the subject in a most comprehensive manner. It fills a definite need and the reliable information it contains will be found invaluable for use in every refinery.

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Practical and scientific data on the manufacture and use of lubricating greases, chemical analysis of many commercial lubricants, abstracts from important patents, formulas and processes for grease production. Contents: Manufacture of Cup Greases, Uses, Tests, Analysis and Patents; Soda Base, Mixed Soda-Lime, Sett, Lead Base and Miscellaneous Greases and Compounded Oils; Mechanical Mixtures and the Trend in Grease Research.

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THE SCIENTIFIC PRINCIPLES OF PETROLEUM TECHNOLOGY—*Dr. Leo Gurwitsch and Harold Moore, 1932 revised edition.*

The original translation of Gurwitsh's second edition (1925) appeared in 1926, and in response to a wide appeal the preparation of a second edition was undertaken by Harold Moore and C. I. Kelly, to include data on technical and scientific work on petroleum to 1932. The well known standard reference work is the most comprehensive treatment of petroleum technology now available.

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PETROLEUM DICTIONARY — *Hollis P. Porter.*

A thorough and comprehensive glossary of terms used in the producing, refining and marketing branches of the petroleum industry. The Petroleum Dictionary of 234 pages presents over 3000 terms and definitions. It is offered those engaged in the industry as a first edition, the author having in mind the compilation and publication of future editions as the need arises. Includes many new words and expressions used in the description of newly developed processes and appliances.

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A valuable tool for the refinery and natural gasoline plant engineer, providing a simple approach to the unit operations of chemical engineering. Based on the film concept and unusual classification of unit operations has been adopted. Introduction by Dr. Arthur D. Little. Chapters—General Considerations, Flow of Fluids, Transportation of Fluids, Flow of Heat, Evaporation, General Mechanism of Diffusion Processes, Humidity and Air Conditioning, Drying, Distillation, Gas Absorption, Extraction, Crystallization, Filtration, Mixing, Crushing and Grinding, Size Separation, Conveying and Weighing.

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HANDBOOK OF PETROLEUM ASPHALT AND NATURAL GAS, Revised Edition Bulletin 25, Kansas City Testing Laboratory—*Dr. Roy Cross.*

This well known handbook was revised in 1931 and increased to 865 pages. Material incorporated in the first edition of Bulletin 25 was brought down to date. The following is included: Economics of Gasoline, Transportation Storage and Gaging, Properties of Crude Petroleum, Refining and Cracking of Petroleum, Properties of Refining Petroleum, Fuel Oil, Oil Shale, Asphalt, Natural Gas, Methods of Analysis, Tables, Patents and Publications. Well illustrated by graphs, charts and photographs, and replete with valuable tabulations. ..

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HOUSTON, TEXAS, U. S. A.

Basil N. Osmin, metallurgy and welding. The headquarters of the bureau are located at 5871 DeGiverville Avenue, St. Louis, and Basil N. Osmin is secretary.

HAROLD BOESEL, assistant resident chemist at Pure Oil Company's Toledo, Ohio, refinery since the middle of 1930, has been transferred to a similar position at the company's Muskogee, Oklahoma, plant. En route he stopped at Troy, Kansas, where he was married to Miss Barbara Wynkoop, sister-in-law to E. O. Sampson, resident chemist at the Toledo refinery.

J. A. THOMPSON, formerly resident chemist at Pure Oil Company's Cabin Creek, West Virginia, refinery, has been transferred to the Toledo plant. F. D. Stoops has been transferred from the company's control laboratory to the Cabin Creek works.

HERBERT P. PEARSON, 19 West 44th Street, New York, until recently with the Standard Oil Company of New Jersey, is now practicing as a consultant on industrial development, specializing in the oil and textile industries.

THE CUSTOMER IS NOT ALWAYS RIGHT

. . . But Neither Are We

No company whose history has been linked with industrial progress over a period of years would presume to lay claim to a record of 100 per cent freedom from trouble with every installation, despite the thousands of successful ones it may have to its credit. But there are those who can point to an enviable record of customer satisfaction based on 100 per cent correction of such troubles. The mistakes one makes are not in themselves a foundation for success. Rectifying them at no cost to anyone else, is.

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REFRIGERATION • ABSORPTION & COMPRESSION
COMPLETE BRIGHT STOCK PLANT DESIGN

L. H. SPINER, Shell Petroleum Corporation, has been appointed assistant manager of the sales promotion-advertising department. He joined the company five years ago as district manager of the Shellane division of the Technical Products department, subsequently being made sales manager and later manager. He was recently elected one of the three members of the Executive Committee, NRA, Liquefied Gas Code Committee.

WALTER G. WHITMAN, Standard Oil Company (Indiana), has been appointed to membership on the Committee on Disposal of Refinery Wastes, Division of Refining, American Petroleum Institute, taking the place of George W. Watts of the same company.

J. WALTER SAYBOLT was recently elected vice president and director of Pennsylvania Lubricating Company, Pittsburgh, Standard Oil Company of New Jersey subsidiary. He began his oil education in the Bayonne laboratories of the parent company in 1901. He is on the directorate of various Standard Oil Company of New Jersey subsidiaries.

ARTHUR L. DAVIS, recently a member of the research staff of Vacuum Oil Company, is now a member of the chemical engineering division of the Tennessee Valley Authority, with headquarters in Knoxville.

PHILLIP BYRNES of the general engineering department of Standard Development Company, was recently transferred to Aruba, D.W.I., where he is in charge of the technical service department.

F. H. GARNER, chief chemist of Anglo-American Oil Company, Ltd., of London, England, has been visiting in New York.

DAVID SHEPARD, Lubrication Engineering Division, Standard Oil Company of New Jersey, has been transferred to London, England, engaging in similar work.

REID S. McBETH, formerly head of the public relations department of Oklahoma Natural Gas Corporation, has been appointed secretary of the new oil industries committee of the Tulsa Chamber of Commerce.

GUSTAV EGLOFF, Universal Oil Products Company, is delivering a series of lectures this month before local sections of the American Chemical Society, dealing with motor fuels and lubricants, synthesis, and modern petroleum refining. Dr. Egloff started a course of lectures at the University of Chicago, early in April; the course relating to the

HOMOGENEOUS ASPHALT

MANY SPECIFICATIONS *Direct* FROM THE UNIT—

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With the Coubrough Process* many types of asphaltic and mixed base crudes—including the domestic—will yield specification asphalt *direct from the unit,* without further processing . . . The economy of the Coubrough Process*, its flexibility, low operating temperatures, high yield and other advantages warrant its careful consideration by those concerned with production costs . . . Aren't you interested in homogeneous asphalt at lower cost?

* *The Coubrough Process is covered by U. S. Patent No. 1,905,156 and other patents allowed and pending.*

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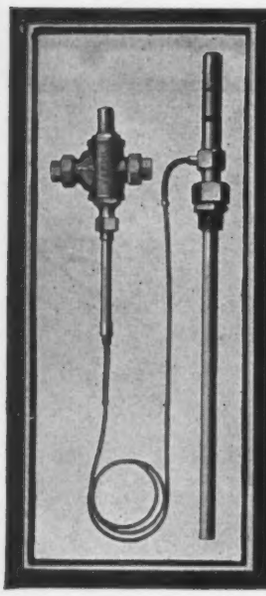
PETROLEUM REFINING PLANTS

thermal decomposition, polymerization, synthesis, and catalytic treatment of hydrocarbons from the scientific and industrial viewpoints, including natural gas, petroleum, shale, and coal industries.

D. A. LITTLE was re-elected president of Magnolia Petroleum Company at its recent annual meeting. E. R. Brown was re-elected chairman of the board, and other officials and directors were re-elected. Re-elected directors of Magnolia Pipe Line Company are the same as those of the parent concern.

WM. H. (JACK) VAUGHAN, for 17 years with the Gulf companies handling gas, gasoline and production work, has established a consulting engineer's office in the Second National Bank Building, Houston, and plans to devote much time to the designing and supervision of construction of gas-lift, vacuum, repressuring and treating plants, supervising the operation of gas lift appliances, treating of oil emulsion, paraffin treating, repressuring, recycling, acid treating of wells, gas measurement and gasoline plant construction and operation.



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. . . . . a Temperature Regulator would need to have these features

A temperature-sensitive system with equal power at any temperature from 0° to 300° F.

A system, therefore, which provides truly throttling control without "hunting" or snap action of valves.

Absolute protection against damage through accidental overheating up to 80° F.

Equal sensitiveness of control at any temperature, whether high or low, regardless of temperature surrounding the valve. This means unequalled results in control of refrigeration.

Valves of the closely balanced, double seated type, equipped with seats and discs of long-wearing chrome-nickel alloy, at no extra cost. Sizes ½" to 2" have union connections for easy installation without danger of damage from heavy wrenches or piping strains.

Complete elimination of stuffing boxes which leak or stick and require constant attention. Instead, packless seals formed from the well known helically corrugated Sarco tubing.

Let us send you a Sarco on 30 days' free trial. If it does not please you, you will not be expected to keep it. Our new catalog No. S-52 should be in your files. Write for it and a free memo-book.

See Our Exhibit at BOOTH No. 611 at the OIL EQUIPMENT ENGINEERING EXPOSITION, Houston, Texas, April 16 to 21

SARCO CO., INC.
183 Madison Ave., New York, N. Y.
Branches in Principal Cities
Sarco Canada Limited, Federal Bldg., Toronto, Ont., Can.

SARCO Temperature Regulator

T. L. PREBLE, Tide Water Oil Company, New York, has been appointed to membership on the Central Committee on Automotive Transportation of the American Petroleum Institute. J. C. Bennett, Associated Oil Company, San Francisco, is chairman of the committee.

J. A. BASTION, formerly chief engineer at the Dallas refinery of The Texas Company, has been transferred to the Port Arthur, Texas, works.

J. K. MacKINNON, formerly assistant superintendent at Spartan Refining Company, Shreveport, is now superintendent at the refinery of the Globe Oil & Refining Company, McPherson, Kansas.

CARL J. HANSEN, engineer, Gulf Refining Company, formerly at the Port Arthur works, is now located in Philadelphia.

DR. JOHN PERL, consulting chemical engineer, Los Angeles, is now located in new offices at Room 922, 707 South Hill Street.

THOMAS G. REYNOLDS, engineer, M. W. Kellogg Company, until recently stationed at Texas City in connection with work on the Pan American Refining Corporation's new refinery, is now located in Ponca City, Oklahoma.

P. L. BRANDT, formerly research chemist for Derby Oil Company, Wichita, Kansas, is now employed as chemist for the Pan American Refining Corporation, Texas City, Texas, and is residing in Galveston.

RAY V. McGRATH, chemist, Empire Oil & Refining Company, formerly located at Okmulgee, Oklahoma, has been transferred to the company's refinery at East Chicago, Indiana.

MILTON LANGENBERG, formerly with Shell Petroleum Corporation, engineering department, St. Louis, is now with The Mathieson Alkali Works, and is located at the plant under construction near Lake Charles, Louisiana.

JAMES H. HERBERT, Standard Oil Company of Ohio, has been appointed to membership on the American Petroleum Institute Committee on Fire Prevention in Refineries. Announcement of the appointment was made by R. E. Wilson, chairman of the Central Committee on Refinery Technology of the Division of Refining. C. E. Townsend, Sun Oil Company, Philadelphia, is chairman of the fire prevention topical committee.

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Any Special Equipment For Your Refinery

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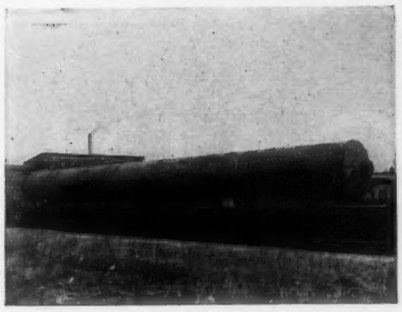
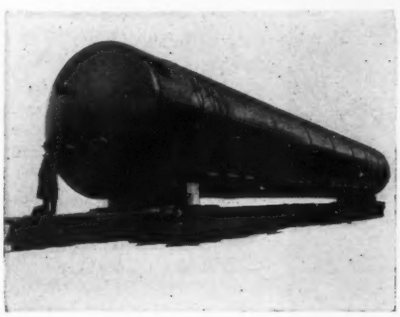
Any Equipment for Your Individual Need





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Have Equipment
Well Made
We Build Only
The Best

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Rail or Water Shipments.

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Estimates on Request.

Sun Shipbuilding & Dry Dock Co.

Chester, Pa.

▼ PLANT ACTIVITIES ▼

Gasoline Plant: Independent Gas Producers, is erecting a 10,000,000 cubic foot compression type natural gasoline plant, 15 compressors, in the new Osage pool, Oklahoma, on Midco Oil Corporation's lease in SE NW Section 10-25-6e. Provisions are made for addition of absorbers later and enlargement of capacity if desirable.

Gasoline Plant: Independent Gas Producers, Ltd., Calgary, Alberta, Canada, A. H. Mayland president, announces plans are maturing soon for actual construction work on the company's absorption gasoline plant in the Turner Valley field.

Operating: Pan American Refining Corporation, Texas City plant, is nearing completion and test runs are under way on the 30,000-barrel combination skimming-cracking unit. Stanolind Oil & Gas Company supplying crude to plant under contract.

Negotiating: Gaunce Oil & Refining Company, Shreveport, Louisiana, headed by Bailey Gaunce, formerly of Fort Worth, Texas, is reported negotiating with Mrs. L. C. Swope of Georgetown, Louisiana, the owner, for the purchase of the old Mid-State Refining Company's 600-barrel lubricating oil plant at Alexandria, Louisiana. If taken over the plant will run on Urania crude. M. E. Nash will be plant superintendent.

GARLOCK
7021

—for severe oil service

Garlock 7021 High Pressure Compressed Asbestos Sheet Packing takes all the punishment of severe service without a whimper! Extreme pressures and extreme temperatures are all in the day's work for this specially developed sheet.

If you are not using Garlock 7021, place an order now and try it out on any job on which compressed asbestos gaskets are being used. Learn for yourself how long this outstanding sheet packing will last in comparison with inferior sheets.

THE GARLOCK PACKING CO.
PALMYRA, N. Y.
Tulsa, Okla. Los Angeles, Cal.
In Canada: The Garlock Packing Co. of Canada, Ltd., Montreal, Que.

Purchase: Magnolia Petroleum Company has purchased the producing properties of East Texas Refining Company, the refineries at Longview and Friars Switch not being included in the deal nor is the company's chain of service stations. Reported consideration $8,000,000, part cash and part Socony-Vacuum Corporation stock.

Docks: The Texas Company recently purchased a five-acre site at Canal Street in East Chicago, on the Indiana Harbor Canal and is to start at once building 500 feet of docks. Gasoline will be shipped by water to Great Lakes ports.

Operating: Mid-West Refineries, Inc., Alma, Michigan, will start operating its new refinery early in April. Distillation unit contract to Leader Industries, Inc.

Move Plant: Louisiana Oil Refining Corporation plans dismantling and moving its Gas Center plant and moving useable equipment to the Bossier City refinery. Capacity 15,000 barrels. Employes of the Gas Center plant will be moved to the Bossier City plant.

Sale: E. G. Winter and associates, Kansas City, reported buying the Egaso Operating Company, Osage, Wyoming, 1000-barrel refinery, and will rehabilitate for operations.

Gasoline Plant: O. H. Grimes, Tulsa, is completing erection of the Chippewa-Greendale natural gasoline plant, Mount Pleasant, Michigan. Capacity 5,000,000 cubic feet.

Close Plant: Standard Oil Company (Indiana) has announced that it will shut down its Casper, Wyoming, refinery during the month of May to reduce stocks.

Rebuild Docks: Sun Oil Company, Shell Eastern Petroleum Products, Inc., and the Servus Oil Company, Trenton, New Jersey, will rebuild loading docks destroyed recently in the ice jam in the Delaware River.

Enlarge: Keystone Refining Company, Detroit, reports plans for enlargement of the Detroit refinery to 700 to 1000 barrels daily.

Repairs: J. J. and M. Taxman Refining Company, Wichita Falls, Texas, has resumed operation after replacement of equipment damaged by fire and explosion last fall.

Refinery: Plainview Refining Company, Plainview, Texas, is erecting a 500-barrel skimming plant on the Fort Worth & Denver Railroad. To secure crude by tank car. Company formed in January by J. C. Hooper, J. N. Jordan, Winfield Holbrook and Mr. Corey.

Refinery: Lubbock Refining Company, Lubbock, Texas, recently completed a 250-barrel skimming plant on the Santa Fe Railroad. To run West Texas and Texas Panhandle crude received in tank cars. Company formed by Everest, Bourland and E. A. Patterson.

Distillation Unit: Mid-Continent Petroleum Corporation reported planning installation of a Foster-Wheeler vacuum distillation system for preparation of lubricants, replacing shell stills now in service. Reported also to be planning installation of contact filtration system.

Refinery: The Sakhalin Oil Trust, U.S.S.R. is installing a new refinery at Khabarovsk, to

serve requirements of the Soviet Far East and Eastern Siberia and to process crude from the Sakhalin oil field. Plant includes cracking equipment.

Clay Plant: The Filtrol Company of California is planning erection of plant for production of acid-activated adsorptive decolorizing clays in the Mid-Continent area; three sites reported under consideration. Plans and specifications for the plant, which is to be larger than the present California plant, are nearing completion. Bids on equipment and material will be called for in the near future.

Stabilizer: Kanawha Oil Company, Jacksonburg, West Virginia, is adding a stabilization system to its natural gasoline plant. Contract to Burrell-Mase Engineering Company.

Operation: Southern Oil Refining Company's 3000-barrel skimming plant, northeast of Kilgore, East Texas field, which has been operated under lease by J. D. Wrather, has been released to Lee H. Gray, principal owner, who will resume operations on completion of minor repairs and replacements.

Refinery: Ocean Refining Company, northeast of Kilgore, East Texas field, has completed erection of 2000-barrel skimming plant and has been connected with LaPrem Refining Company's 1500-barrel skimming plant near Kilgore townsite with six-inch pipe line.

Cracking Unit: Southport Petroleum Company, northeast of Kilgore, East Texas field, is completing construction of a cracking unit early in April. Will crack fuel oil stored in earthern pits.

Lease Plant: Eastern States Petroleum Company, Inc., 1776 Broadway, New York, to operate in Texas as Petroleum Processing Corporation, has taken a lease on East Texas Refining Company's 6000-barrel plant at Friars Switch, East Texas field. Petroleum Processing Corporation, Delaware, granted permit to operate in Texas with the following directors: L. J. Walsh, Rich B. Kahle, Geo. A. Davis and Dan V. Armstrong. Kahle was formerly chairman of the board of Louisiana Oil Refining Corporation. To operate at 5000 barrels daily, skimming gasoline, diverting "tops" via rail to Gulf Coast for delivery to connections on the Atlantic Coast.

Refinery: Acme Refining Company is erecting a small skimming plant in the Gladewater Townsite section, East Texas field. Company formed by J. H. Talley, J. N. Whitlock and Elbert Holmes.

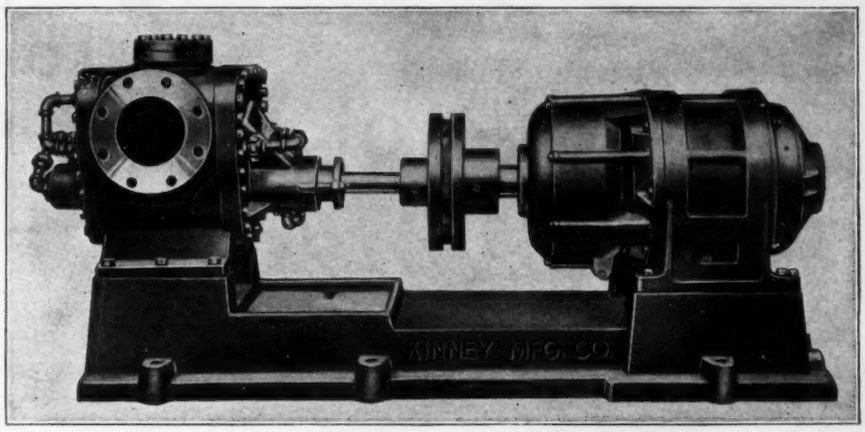
Chemical Plant: Shell Oil Company, Shell Building, San Francisco, engineering department, is drawing plans for enlargement to its chemical plant, including installation of new equipment. Reported cost $250,000.

Enlargement: Shamrock Oil & Gas Company, Amarillo, Texas, contract to Stearns-Roger Manufacturing Company, Denver, covering addition to its McKee absorption gasoline plant to double capacity. Plant located in Section 59, Block 25, H.&G.N. Survey, Moore County, Texas Panhandle. Additional absorbers, stills, exchangers, cooling tower, pumps and tankage.

Purchase: Consolidated Oil Corporation has purchased the West Tulsa refinery of Producers & Refiners Corporation, which has been in federal receivership, for the minimum bid of $450,000, at the receiver's sale. Tankage, stored oil, gasoline, semi-refined oil and other material was not included in the sale although a bid was received for it from Consolidated, the sufficiency of the bid to be determined later.

(May we suggest that you clip this ad and others in this series for your "pump" file?)

• • • • 163 KINNEY PUMPS Wrote This Ad! • • • •



Operating from 1 - 22 years in refinery service, repair parts for these 163 Kinney pumps have totalled only 15.6% of the original cost—$24.74 per pump year!

Years in Service	No. of Pumps	Total Years of Service
22	3	66
20	7	140
19	6	114
18	2	36
17	3	51
16	1	16
15	18	270
14	29	406
13	4	52
12	3	36
11	3	33
10	18	180
9	9	81
8	6	48
7	1	7
6	12	72
5	13	65
4	16	64
1	9	9
Total...	163	1,716

Low pump repair part cost is desirable in itself and important, too, because it means few costly pump failures to cause plant shut downs.

Just as refinery conditions vary, so do Kinney repair part cost records. $24.74 per pump year is featured above, last month's ad featured a record of $4.68 for 351 pumps.

BUT the important point is that the highest record is so low for such service that the user continues to buy Kinney pumps year in and year out. The reason lies in the pump itself as the nearest Kinney man will gladly demonstrate—or as you will see from a study of Bulletin 10. A copy is yours for the asking.

(Total sales price for 163 pumps, $271,989 or an average cost per unit of $1656.25. Total repair parts, $42,380. Average cost per pump for repairs over the entire period, $260.00)

KINNEY MFG. CO.
3539 Washington St.
BOSTON

30 Church St. NEW YORK
725 Commercial Trust Bldg. PHILADELPHIA
1202 Buckingham Bldg. CHICAGO
407 Finance Bldg. KANSAS CITY, MO.
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For All Treating Operations: Whether you are most interested in Naphtha Treating, Gas Scrubbing, Acid Neutralizing, or Water Softening—there is a grade of **PIONEER OYSTER-SHELL LIME** especially adapted to your requirements. Let us discuss your treating problems and recommend the PIONEER LIME that will: **reduce operating cost; increase over-all efficiency; improve the quality products made.**

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MFRS. OF PIONEER OYSTER SHELL LIME
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HOUSTON-TEXAS

12 ounces of *prevention*

M·S·A SKULLGARDS

Twelve ounces of prevention against all manner of head injuries, worth many pounds of cure. Worth many dollars in reduced compensation costs, too, because head injuries are among the most prevalent common accidents.

Give your men the protection of MSA Skullgards . . . moulded in one seamless piece of durable micarta . . . remarkably strong . . . non-conductive . . . immune to water-softening . . . comfortably light. The cushioned lining easily conforms to the shape of the head, and provides air space between head and helmet for coolness and shock-protection. The broad rigid brim protects the face, ears and neck.

MSA Skullgards are made in a wide range of types and sizes to meet the needs of every industry. Write for a descriptive bulletin, or let us arrange a demonstration for you—naturally without obligation.

MINE SAFETY APPLIANCE CO.

Braddock, Thomas and Meade Streets, Pittsburgh, Pa.

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MSA Equipment Includes Breathing Apparatus . . . Inhalators . . . Masks of all Types . . . Gas Indicators . . . Eye and Head Protectors . . . Edison Electric Cap Lamps . . . Safety Clothing . . . First Aid Equipment . . . Descriptive Bulletins will be sent upon request.

The Safe, Economical and Dependable Drive

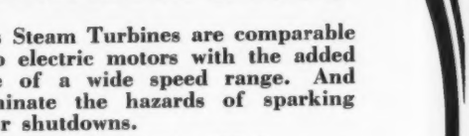
—Coppus Steam Turbines are comparable in cost to electric motors with the added advantage of a wide speed range. And they eliminate the hazards of sparking and power shutdowns.

Write for Bulletin 135-6

COPPUS ENGINEERING CORP.

360 Park Ave.
Worcester, Mass.

COPPUS
Hot Gas and Forced Draft Blowers, Tank Ventilators and Exhausters. Heat Killers, Cooling Fans.



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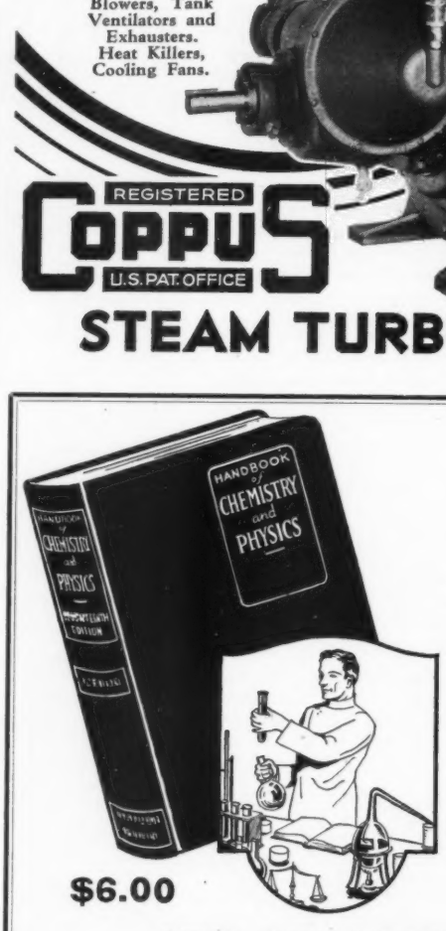
STEAM TURBINES



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New Equipment for the Modern Plant

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The Harnischfeger Corporation, Milwaukee, Wisconsin, has built a general utility crane known as the "Hustler," which provides increased transporting speeds combined with greater capacity and stability. Its uses include the handling of material and industrial equipment, log and pipe handling. It is also convertible for clamshell crane, drag-line scraper, pile driver or tractor service.

Designed primarily for faster handling of loads, this new type heavy duty crane is unique in engineering, one of its most unusual features being its flexible drum arrangement. There are two side drums and a front drum, all of which rotate independently. Each drum has three forward speeds and one reverse speed. The live, power driven boom is adjustable to any desired working angle and can also be readily removed. When working conditions require, it may be changed from one side to the other by drawing the removable pins from the hinge at the boom foot.

With three-speed traction, the "Hustler" crane has an easy change of pace to meet all requirements and to go anywhere it can get traction. The speed of 5.2 miles an hour is an advantage. The intermediate speed of 2.6 miles per hour is practical for most working conditions, while the low speed of 1.3 miles per hour meets the more severe demands for power.

Friction clutches are band type with large diameter to insure easy, smooth operation with heavy loads. Loads may also be lowered by power by throwing in the reverse gear. Control of the load is maintained at all times.

Gears are fully enclosed and run immersed in oil. Roller bearings are used throughout the main machinery, while renewable bronze bearings are used in the traction mechanism to withstand the abrasive action of mud and grit.

Chain Hoist

AMERICAN CHAIN COMPANY, INC.

Wright Manufacturing Division of American Chain Company, York, Pennsylvania, announces an improved spur-geared chain hoist; improved to increase durability, efficiency and usefulness. All exposed parts are zinc coated, making the hoist practical for outdoor use and in moist or corrosive atmosphere. Precision ball bearings have been added with integral grease seals supporting all moving parts. Wear is said to be reduced to a minimum on all vital moving parts by a system of continuous lubrication of the positively sealed precision bearings. Other improvements include the hardened pawl tip, improved load chain and ball springs on oil tubes.

Welded Tanks

COLUMBIAN STEEL TANK COMPANY

Columbian Steel Tank Company, Kansas City, Missouri, has announced a new tank fabrication development which applies to erection of welded storage tanks. The new type tank has been called the "Catch-Bolt Welded Tank."

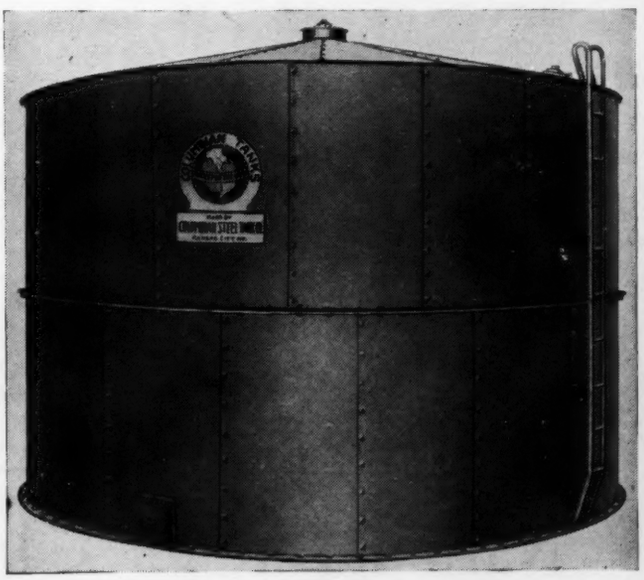
It consists merely of cutting, curving and punching the sheets for the tank on the regular bolted tank machinery in the Columbian plant, excepting that the sheets are punched for bolts every 12 inches or more, instead of every two inches as is done in regular bolted tanks.

The sheets for the tank are then shipped to the erection site where they are set up, and catch-bolted through the scattered bolt holes. The tank is trued to perfect round, and plumbed. Then the welding crews go to work, welding every seam inside and out. All they have to do is weld, the tank being held strong and rigid for them by the bolts in it.

This innovation in tank fabrication saves time and produces a superior tank, the manufacturer claims. It eliminates possibility of warped, off-round tanks.

The originators of the method find it will save much time in "cutting out" the tanks, givnig accuracy and precision, and offers saving in erection costs.

At left: Harnischfeger Crane



Above: Columbian Welded Tank

Gas-Air Regulator

CHAPLIN-FULTON MANUFACTURING COMPANY

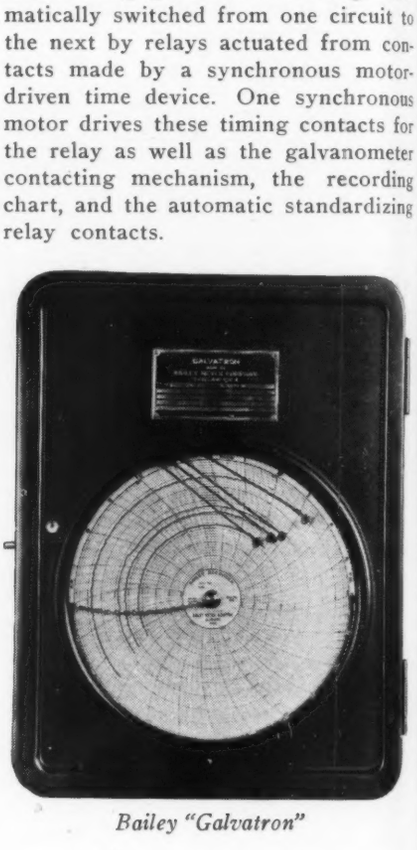
Chaplin-Fulton Manufacturing Company, Pittsburgh, has announced a new duplex gas-air proportioning regulator designed to do away with the necessity of installing first a reducing regulator, then a proportioning regulator. The new regulator is said to not only maintain constant pressure ratio between gas and air supply but will reduce initial gas pressure to that required for all of the burners. The design permits it to perform the two operations with a single setting with a saving in initial outlay. The regulator is installed in the gas line supplying the burners, outlet pressure being connected to the lower diaphragm and the air pressure to the upper diaphragm. The regulator functions through a definite pressure ratio since the volume is in direct proportion to the pressure. It is so designed and constructed that by the application of the gas and air pressures to two separate diaphragms of unequal area, a definite predetermined pressure ratio can be maintained between the gas and air.

Potentiometer Pyrometer

BAILEY METER COMPANY

Bailey Meter Company, Cleveland, Ohio, announces a new potentiometer pyrometer which has been named "Galvatron" after the Galvanometer-electronic relay circuit which it employs to operate slide wire resistance and recording pens.

One Galvatron may include as many as four potentiometer circuits, the contact making galvanometer being automatically switched from one circuit to the next by relays actuated from contacts made by a synchronous motor-driven time device. One synchronous motor drives these timing contacts for the relay as well as the galvanometer contacting mechanism, the recording chart, and the automatic standardizing relay contacts.



Bailey "Galvatron"

The Galvatron mechanism consists of a galvanometer of short period arranged to make contacts of a duration proportional to the deflection of the galvanometer needle from neutral. These contacts which close the circuit to the electronic relay carry only a few micro-amperes of current, and are connected to the grids of Pliotron tubes. A galvanometer contact permits the flow of direct current through one pliotron tube and the DC winding of its transformer whose second winding is in series with one field coil of a reversible synchronous motor driving the potentiometer unit. This flow of direct current permits a flow of alternating current through the transformer and field coil, thereby rotating the motor in one direction. Rotation in the opposite direction is produced in

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OIL METERS

NATIONAL METER COMPANY

The original meter of the oscillating piston type. Used in refineries throughout the world.

Empire Meters are highly accurate, strong, and durable. They are easy to install and economical to operate. They maintain remarkable accuracy under conditions which would soon ruin the accuracy of any ordinary meter.

The Empire Oil and Gasoline Meter

National Meter Company

Executive Offices and Factory: 4213 First Avenue, Brooklyn, New York

Texas Branch: 1208 Dallas Bank and Trust Building, Dallas, Texas

BOSTON CHICAGO LOS ANGELES SAN FRANCISCO

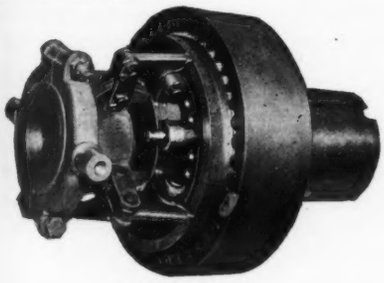
the same manner by energizing the other field coil through a second electronic relay when the galvanometer needle swings to the other side of neutral.

A feature of the Galvatron is its continuous record or records, up to four in number, made on a circular recording chart. When more than one record is provided for, each is made in a different color of ink so that it can be distinguished from the others on the chart, regardless of how many times they cross each other. In the case of a multi-pen Galvatron recorder, all records are continuous, although the contacts made by the galvanometer needle are divided among the potentiometers. In the case of a one-pen recorder, all contacts made by the galvanometer serve to adjust the potentiometer, which in this case is adjusted every four seconds if necessary. In the case of a four-pen recorder, each potentiometer receives a contact every 16 seconds, so that each record is a smooth continuous picture of existing conditions.

Clutch

TWIN DISC CLUTCH COMPANY

Twin Disc Clutch Company, Racine, Wisconsin, has developed a new line of clutches which will be known as the B. F. T. Series. These clutches combine all of the good points of the former Models B., F. and T, according to the manufacturer.



B.F.T. Clutch

Capacities range from three horsepower per 100 r.p.m., to 80 horsepower per r.p.m. The series comprise eight sizes of clutches: 6½-, 8-, 10-, 11½, 14-, 16-, 18-, and 24-inch. The 6½- to 14-inch sizes are made with one, two or three plates, while the 16-, 18-, and 24-inch are furnished with one or two plates, as required.

Suitable driving spiders for use with all sizes mentioned have been developed. These spiders are available in three different styles for various installations, and are all of the internal gear tooth drive type.

All clutches are of the toggle action type, and in addition to using gear tooth driving plates, have the inner plates that take their drive from the hub in the same manner.

Hard Surface Electrode

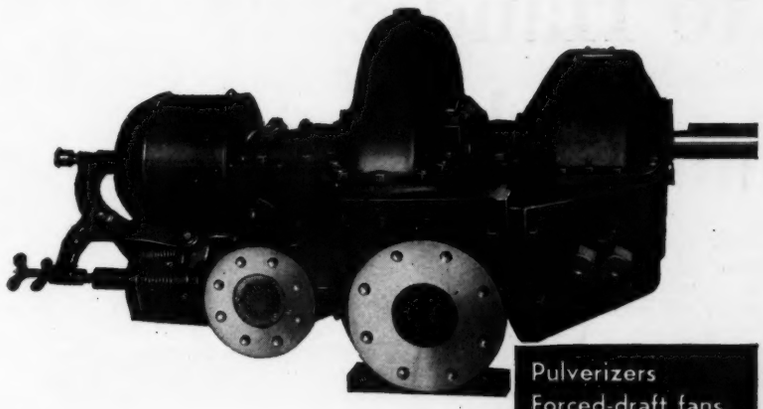
LINCOLN ELECTRIC COMPANY

Lincoln Electric Company, Cleveland, Ohio, is offering a new shielded arc electrode for building up steel surfaces to resist shock and abrasion. It is being called "Wearweld." Deposits made with this electrode are air hardening alloy steel with an unusual combination of hardness and toughness, according to the manufacturer. Wearweld can be used to build up all steels other than those of the austenitic type. It is said to be particularly valuable for facing parts subjected to rolling or sliding abrasion, batter, sand abrasion and repeated impact.

The deposited metal has exceptional hardness, depending to some extent upon the composition of the base metal. A single layer on mild steel has a hardness of 40 to 45 Rockwell C. Additional layers will have a hardness of 48 to 52 Rockwell C, it is claimed. On 70 carbon steel, a single layer will have a hardness of 50 to 55 Rockwell C.

The heavy coating of this electrode provides a shielded arc allowing the transfer of molten metal to take place under non-oxiding conditions. It also provides a layer of slag which further

NOW THE NEW G-E GEAR-TURBINE FOR YOUR LOW-SPEED DRIVES



Pulverizers
Forced-draft fans
Stokers
Ventilating fans
Induced-draft fans
Low-speed pumps
Compressors
Conveyors

THE new G-E gear-turbine combines a mechanical-drive turbine and a reduction gear in a single compact unit. Designed for drives that require speeds lower than those obtainable with ordinary turbines, it is available in speed ratios as high as 12 to 1. Capacities range from 10 hp. to 150 hp.

The G-E gear-turbine is easily mounted and aligned because of its self-contained, close-coupled construction; and having no excess parts, it runs at high over-all efficiency. Enclosed gears, running in oil, carry the rated turbine output with an ample factor of safety, while the unified design of gear and turbine insures a permanent gear alignment. Let us tell you more about the low costs and operating advantages of this new power unit. Simply mail the attached coupon, or call the nearest G-E sales office.

GENERAL ELECTRIC

General Electric Company, Dept. 6A-201, Schenectady, N. Y.

Please send me a copy of your bulletin, "GEAR-TURBINES FOR MECHANICAL DRIVE" (GEA-1855).

Name.....

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720-220

protects the metal from the harmful effects of the air and causes the weld metal to solidify in a smooth uniform bead.

Good deposits may be made in very thin layers if required. If shaping is necessary, the deposit may be ground to size.

Wearweld electrode is manufactured in two sizes — one-quarter and three-sixteenth-inch diameter, and 18-inch lengths. It is packed in 50-pound steel containers.

Packing Ring

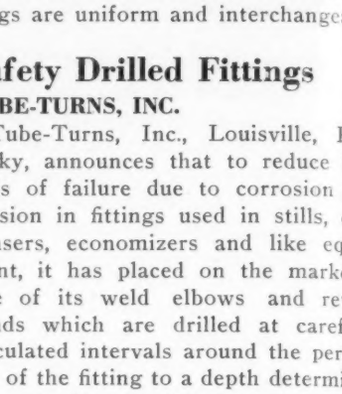
AMERICAN METALLIC PACKING COMPANY

American Metallic Packing Company, Pittsburgh, has introduced a new type of packing ring designed for severe service in natural gas pump stations, on gas engines and gas compressor rods, and which are said to be equally efficient on steam engine rods using superheated steam. Each ring is an individual casting of specially dense iron, and five rings constitute the standard installation. The rings are available in any diameter. The ring uses a new type hoop spring to secure even and constant tension. The rings are uniform and interchangeable.

Safety Drilled Fittings

TUBE-TURNS, INC.

Tube-Turns, Inc., Louisville, Kentucky, announces that to reduce hazards of failure due to corrosion and erosion in fittings used in stills, condensers, economizers and like equipment, it has placed on the market a line of its weld elbows and return bends which are drilled at carefully calculated intervals around the periphery of the fitting to a depth determined by operating conditions under which the fitting is to be used. When the fitting has corroded to a point where the wall thickness is reduced to approximately its safe limit, one or more of the drill holes is exposed and a small leak occurs, warning the operator that the fitting should be replaced.



Tube-Turns Drilled Fitting

Foam Generator

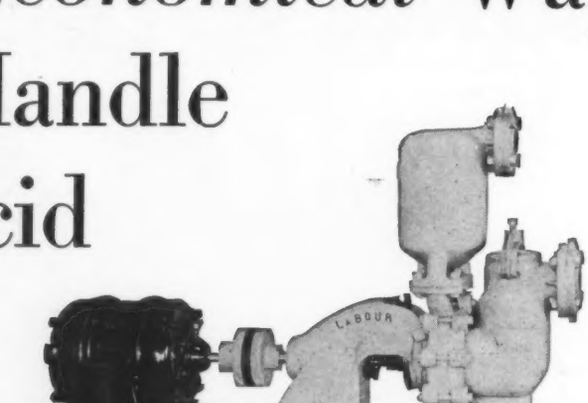
PYRENE MANUFACTURING COMPANY

Pyrene Manufacturing Company, Newark, New Jersey, announces the Phomene hopper, a continuous foam generator embodying new ideas of design and construction. The manufacturers claim for their product an unusual simplicity, sturdiness and performance.

The Phomene hopper is a device for converting a fire line from a continuous water stream to a continuous foam stream. This unit is coupled into a hose line. Water enters at one side; Phomene powder is poured in the hopper and foam is discharged through the hose line at the other side of the unit. The Phomene hopper is designed for fire department and industrial service wherever quantities of flammable liquids are used or stored.

The Phomene hopper has no levers, valves, gauges or moving parts. It is a complete unit built ready for use. There are no parts to be assembled. The base is malleable iron. The hopper and hopper bowl, cast of special com-

The *Economical* Way to Handle Acid



LaBour

Economy of time, of labor, and of maintenance costs follows the installation of LaBour pumps for handling corrosive liquids in refineries. Available in self-priming or gravity feed types, they start to move liquid promptly and certainly whenever they are called upon. The self-priming type provides extraordinary safety due to the fact that much of the line can be at less than atmospheric pressure. The hazards of bottom outlets and gravity feed are completely excluded.

The simple, rugged design of LaBour pumps makes them reliable. There is but one moving part —the impeller—and there are no valves, floats or other troublesome accessories. Time-out for repairs or replacement is down to the minimum when you use LaBour pumps.

Let the experience of the LaBour organization help you. This organization has long specialized in the problems involved in handling and conveying liquids in process plants. You will be under no obligation or cost in asking for full information.

THE LABOUR CO., INC. 407 STERLING AVENUE ELKHART, IND.

ORIGINATORS OF THE SELF-PRIMING CENTRIFUGAL PUMP

position metal, cannot be bent out of shape. Powder pails can be pounded on a slam bar to empty their contents completely and quickly. The unit weighs only 42 pounds and is easily carried in one hand.

It is claimed that the flow of powder is governed automatically by the pressure and amount of water available and that the device operates efficiently with water pressure as low as 35 pounds. An auxiliary water jet in the hopper erodes the powder and flushes it into the main water stream passing through the base.

Valves

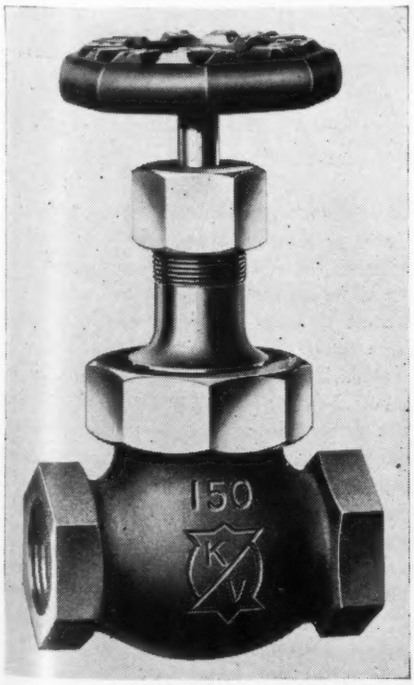
THE KENNEDY VALVE COMPANY

The Kennedy Valve Company, Elmira, New York, is offering a new line of heavy standard bronze globe and angle valves. An interesting departure in these valves is the cadmium plating of the malleable iron union bonnet ring and stuffing box nut. This finish was selected from among many others after accelerated weathering tests had shown that it afforded permanent protection against rusting, and an additional advantage is that it was a self-lubricating quality on the threads. The cadmium plating will not chip or wear off and also adds to the attractive appearance of the valves.

The union bonnet ring construction is used for these valves because of its general acceptance as best engineer-practice, with malleable-iron bonnet ring for strength and rigidity, and a bronze-to-bronze true union joint between the body and the bonnet.

A feature of these valves is the special design of the bearing surface between the stem and the disc holder. The stem head has a rounded machined bottom surface which makes a low-friction bearing contact with a smooth milled recess in the disc holder. This construction reduces friction to a minimum and makes it easier to start the valve open and to close the valve to an absolutely tight position.

Another feature which reduces operating friction is the use of four guide prongs on the disc holder which prevents tipping or binding of the disc holder as the valve is opened or closed.

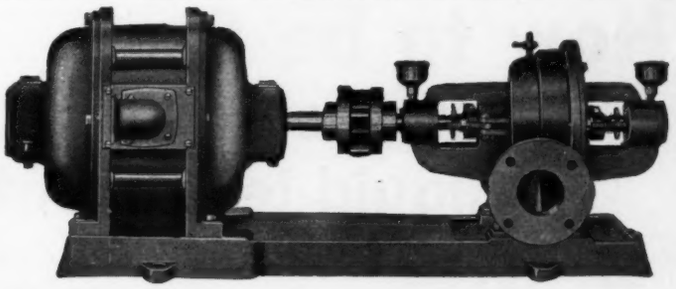


Kennedy Valve

Acid Pumps

THE U. S. STONEWARE COMPANY

The U. S. Stoneware Company, 50 Church Street, New York, announces a new and improved line of armoured centrifugal acid pumps, which are chemical stoneware lined to insure resistance to corrosion. These pumps are applicable to the handling of hot or cold acids, caustic solutions, abrasive slurries, and the like. The casing, impeller and all parts coming in contact with the corrosive solution are made of "U. S. Standard" chemical stoneware, de-aired and vacuumized for greater



THIS PUMP does NOT vapor bind!

For handling volatile liquids containing large amounts of vapor, select Westco Turbine Pumps every time.

Westco's Multi-Vaned Impeller. It does the "business".

NUMEROUS large Refiners and Natural Gasoline Plants swear by Westcos on account of their high efficiency when handling light, volatile gasoline, propane, etc., with 100° to 130° A. P. I. gravity. On such severe duties, this advanced, turbine-type pump operates against pressures up to 300 lbs. per square inch without becoming vapor bound.

increasing the efficiency of the towers, this characteristic makes Westco the ideal pump for feed and reflux duty on high pressure stabilizers. Our Refiner friends also like Westcos for Still Charging and for handling Hot Oil, Fuller's Earth, Chlorine Treating Solutions, Mineral Seal Oils, Naphtha, Brine, Water, etc.

High Pressures in Single-Stage

Westco's re-energizing pump action produces pressures which, in many cases, are as much as *20 times greater* than those produced by conventional type centrifugals with the same diameter Impeller.

Automatically Adjust

Even if the operating pressure might fluctuate considerably, Westco *automatically adjusts itself* to such changes. A steady, non-pulsating flow is assured at all times. By

Send Coupon for Details

Just fill in the coupon below and mail it today for FREE Catalog together with Performance and Selection Tables. WESTCO PUMP CORPORATION, Davenport, Iowa. *Branches:* New York, Philadelphia, Chicago, Los Angeles and San Francisco. *Representatives in 50 Principal Cities.*

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WESTCO *TURBINE* PUMPS

HIGH PRESSURE - - - SINGLE STAGE

strength, or with "Acitherm" heat resisting stoneware as requirements dictate. The cast iron outer shell gives the pump a permanent protective armour, enabling it to withstand rough handling. The manufacturers state that the double packing gland prevents all spraying; the gland adjustment is semi-automatic, securing temperature compensation to maintain constant gland pressure; the impeller clearances are adjustable; the design gives accessibility, permitting rapid removal of any wearing parts, and all parts are standardized; the stoneware parts are ground into the protecting armour rather than being cemented in; corrosion resisting alloys are used for all metal parts that may be injured by highly corrosive fumes.

Steam Trap

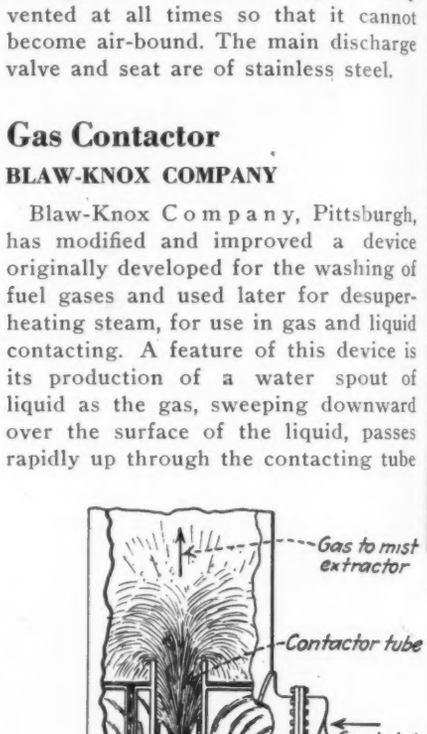
SARCO, COMPANY, INC.

Sarco Company, New York, announces the combination float-thermostatic trap Type FTO-H as an addition to its line of steam specialties. It carries the working pressure for which this type is now available to 180 pounds per square inch. The trap is compact in design, light in weight, so that it can be supported directly on the piping. Inlet and outlet are on the same side, a small vertical distance apart for easy connection to horizontal piping. All working parts are on the cover and can be exposed for cleaning by simply removing the trap body and without disturbing the connections. The automatic by-pass is arranged on the down-board side of the trap so that the thermostatic element is at no time exposed to the full steam pressure. This arrangement is said to keep the trap vented at all times so that it cannot become air-bound. The main discharge valve and seat are of stainless steel.

Gas Contactor

BLAW-KNOX COMPANY

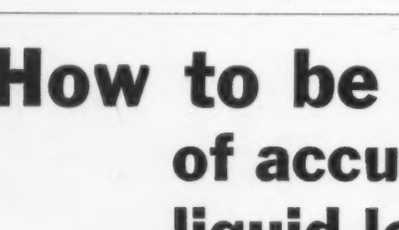
Blaw-Knox Company, Pittsburgh, has modified and improved a device originally developed for the washing of fuel gases and used later for desuperheating steam, for use in gas and liquid contacting. A feature of this device is its production of a water spout of liquid as the gas, sweeping downward over the surface of the liquid, passes rapidly up through the contacting tube



Blaw-Knox Gas Contactor

or tubes. Depending upon requirements, the apparatus may be built with several tubes in a single stage or with as many as three contacting stages. Intimate contact between gas and liquid is assured by the double current of liquid through which the gas must pass. Some of the liquid trickles down the tube and at the bottom is swept back into the vortex, forming a second curtain. In addition to gas scrubbing, desuperheating and gas cooling, the apparatus is being employed for gas and air hydration, and for oxidation, chlorination, aeration and like services. It has also been used in absorption where not more than three stages of contacting are required. The manufacturer states that it has no moving

How to be Sure of accurate, safe liquid level control . . .



No liquid level controller can be more accurate or more safe than its stuffing box and spindle bearing. These devices must be able to hold pressure or vacuum, without leakage and to eliminate friction and thus give accurate level control.

In studying these important features, we suggest that refining engineers investigate the special features of K & M Easy-to-Pack Stuffing Boxes and Ball Bearing Spindles, which are an integral part of K & M Liquid Level Controllers. They give practically frictionless operation because of their external ball bearing design. They are highly efficient for either vacuum or pressure because of the patented stuffing box design.

Bulletin C5, gives complete information about these features. The bulletin also covers K & M Controllers of the direct connected and remote control type with either external or internal floats. Write today for your copy. No obligation.

Special Features of K & M Easy-to-Pack Stuffing Box and Ball Bearing Spindle

Ball Bearing

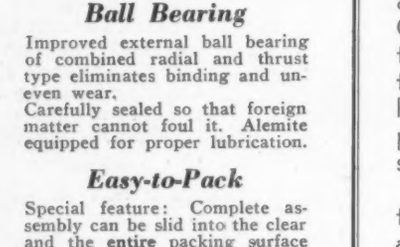
Improved external ball bearing of combined radial and thrust type eliminates binding and uneven wear.
Carefully sealed so that foreign matter cannot foul it. Alemite equipped for proper lubrication.

Easy-to-Pack

Special feature: Complete assembly can be slid into the clear and the **entire** packing surface reached.

For High Pressure or Vacuum

Efficient for every condition regardless of viscosity of liquid. Safe for inflammable liquids or where dangerous gases form. Other features: Write for Bulletin C-5.



K & M No. 250 equipped with Easy-to-Pack Stuffing Box and Ball Bearing Spindle.

KIELEY & MUELLER, INC.

Main Office and Warehouse:
34 W. 13th St., New York, N. Y.
Plant: **Newark, N. J.**

K and M Liquid Level Controllers

OTHER K & M PRODUCTS: VALVES; Pressure Regulating, Air Pilot Operated, Balanced, and Back Pressure. PUMP GOVERNORS; STEAM TRAPS

parts, is self-cleaning, the gas velocities are not critical; it is of high capacity; high efficiency mist extractors are used at the discharge and it may be fabricated from any suitable corrosion resisting material desired.

Hot Oil Pump

INGERSOLL-RAND COMPANY

Ingersoll-Rand Company, 11 Broadway, New York announces Cameron Class AHT hot oil charging pumps, which are high pressure centrifugal pumps designed for the purpose of handling high temperature oils encountered in cracking process service. The pump is a horizontal single suction, closed-impeller turbine type with a barrel casing. It is supported at the centerline on water-cooled cradles having provision for expansion in any direction without affecting alignment of the unit. The suction and discharge nozzles are directly over the main supports, thus eliminating the possibility of distortion due to normal piping strains. All parts of the pump are proportioned to provide adequate strength and safety in operation. Each pump handling hot oil said to be given special attention and consideration as to materials entering into its construction by the Ingersoll-Rand matallurgical laboratory. Many pumps handle noncorrosive oils, where carbon steel can be satisfactorily used, but when handling sulphur bearing oils, special consideration must be given to parts subject to high velocities, and corrosion resistant chrome steels are provided. The pumps are arranged for dual drive, and can be quickly switched from one drive to another. Stuffing boxes are under suction pressure only. The hot liquid is safety sealed throughout. The pump is a 10-stage centrifugal, built to operate at pressures up to 1250 pounds per square inch.

Conduit

THE AMERICAN BRASS COMPANY

The American Brass Company, 25 Broadway, New York, announces a new rustless, corrosion resistant electrical conduit. It is made of Everdur metal, and has been listed under "Factory Inspection and Label Service" by Underwriters' Laboratories as "Electrical Metallic Tubing", but is marketed under the same "Everdur Electrical Conduit." The manufacturers state that the metal is immune to rust, and highly resistant to a wide variety of corroding agents, and that the conduit has passed required tests for short circuit and ground, resistance to arcing, electrical bonding and fittings, tensile and compressive strength, resistance to impact and bending qualities.

Items About Manufacturers

The Babcock & Wilcox Company announces that the territory served by its Tulsa, Oklahoma, sales office, managed by C. J. Hochenauer, has been enlarged to include Oklahoma and the southern half of Kansas.

Chemical Construction Corporation announces that after April 16, the address of the company headquarters will be 30 Rockefeller Plaza, moving there from 535 Fifth Avenue, New York City.

Hagan Corporation, Pittsburgh, announces the appointment of E. W. Wagenseil to the new created position of general sales manager for the company and its subsidiaries—The Buromin Company, Hall Laboratories, Inc., and Calgon, Inc. The latter company has just been organized to market Calgon products. Wagenseil has been in the sales department of Hagan Corporation for the past two years handling combustion control and boiler water conditioning.

The Filtrol Company of California has announced plans for construction of a new plant to be located in the Mid-Continent area, according to Lester L. Robinson, chairman of the board, and G. Howard Hutchins, president. The exact site of the new plant has not been definitely determined, although three are under consideration. Plans and specifications for the new plant for the production of acid-activated clays of high adsorptive and decolorizing quantities, are nearing completion. Bids on equipment and material will be called for in the near future. The new location will give refiners the advantage of lower freight rates on the finished Super-Filtrol. The source of supply of the raw material is such that it will readily lend itself to delivery in the Mid-Continent section.

Kellogg Equipment Corporation, Rochester, New York, has been recently organized with officers as follows: H. M. Smith, president, J. J. Sharp, vice president in charge of sales, and J. F. Weller, secretary-treasurer. The new company will operate as the sales department for Kellogg Manufacturing Company, Rochester, manufacturers of air compressors and air measuring equipment; Greencastle Manufacturing Company, Greencastle, Pennsylvania, manufacturers of general shop equipment; and Oildraulic Lift Company, Memphis, Tennessee, manufacturers of automobile lifts.

Landis Machine Company, Waynesboro, Pennsylvania, has announced that its Victor plant, also located in Waynesboro, will henceforth be known as "Landis Machine Company" Tap Division."

This change in name has been brought about by the fact that the new line of collapsible taps recently placed on the market will be known as "Landis Collapsible Taps." The manufacture of the older line of Victor taps has been discontinued, being superseded entirely by Landis taps of the newer design.

Merco Nordstrom Valve Company of Pittsburgh, Pennsylvania, subsidiary of the Pitts-

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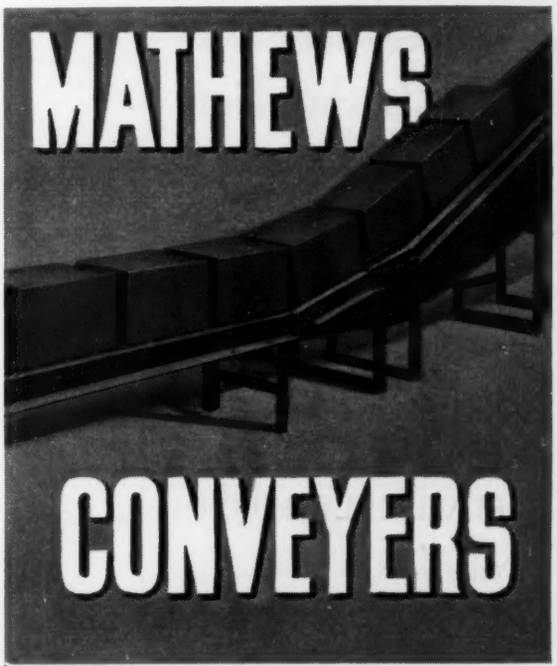

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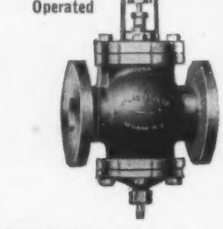

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burgh Equitable Meter Company, has established a new district to serve the territory of central and western New York state. C. F. Thomas, who has been acting as New York state representative for a number of years, will be district manager in charge of the new territory, assisted by D. A. Gardner, who has also represented the company in the past in various sections of the country.

An office will be opened at some point in this territory in the near future—the exact location to be announced as soon as negotiations have been completed.

EVERETT CHAPMAN

Lukenweld, Inc., division of Lukens Steel Company, Coatesville, Pennsylvania, announces that Everett Chapman, who joined the company early in 1930, as director of engineering and research, has been elected vice president of that company, which is engaged in the design and manufacture of welded steel assemblies for machinery and equipment.

Ralph G. Caulley has joined the Detroit district sales office of Republic Steel Corporation, according to announcement made by N. J. Clarke, vice president in charge of sales. Mr. Caulley had been connected with Wheeling Steel Corporation for 14 years, the last seven of which were spent in Detroit.

C. R. Messinger, chairman of the board of Chain Belt Company, Milwaukee, has resumed the post of president of the company, left vacant by the death of his brother, Clifford F. Messinger, in December. For the past three years Mr. Messinger has been president of Oliver Farm Equipment Company and was recently elected chairman of the Oliver board.

In resuming the presidency of Chain Belt Company, Mr. Messinger again takes over the active management of a company with which his name has long been associated. Joining this company in 1917, as vice president and general manager, he became president in 1923 and continued in that position through 1930. He resigned December 31, 1930, to become president of Oliver Farm Equipment Company, and at the same time became chairman of the board of Chain Belt Company, his brother, Clifford F. Messinger, succeeding his as president.

G. K. Viall, a vice president, was elected to the vacancy on the Chain Belt board, created by the death of Clifford F. Messinger. He has been with the company since 1921, serving successively as assistant to president, works manager, and vice president.

Manhattan Rubber Company, Passaic, New Jersey, has announced the appointment of Charles H. Bauer as merchandising manager of its V-belt department. He has had wide experience in the specialized field.

Sarco Company, New York, announces announces appointment of Emilio N. MacKinney as its sales representative for Mexico City, Mexico, Mr. MacKinney is a Mexican, educated in the United States and a graduate of the Massachusetts Institute of Technology. He and his associates will handle the full line of Sarco steam specialties, such as steam and radiator traps, temperature regulators, strainers, etc.

John Zink Company, Tulsa, manufacturers of burners and other combustion equipment, has moved offices from the Oklahoma Natural Gas Building to 425 East Fourth Street in Tulsa, the new location adjoining the company warehouse and plant.

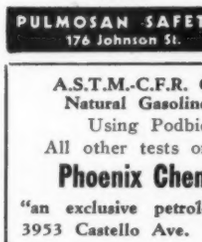
Steel and Tubes, Inc., Cleveland, announces that William F. Sailer, formerly with Alco Products, Inc., and Griscom-Russell Company, has been appointed to a position in the company's sales department, to be located in Brooklyn, New York, where he will concentrate his efforts on the oil refinery and marine fields.

Link-Belt Company announces that W. G. Hudson, has been appointed chief engineer of the company's Pershing Road plant in Chicago.

B. F. Sturtevant Company, Boston, announces election of Gardner C. Derry, sales manager, power division, as vice president.

Worthington Pump & Machinery Corporation, Harrison, New Jersey, announces that William M. Kauffman, formerly with National Transit Pump & Machine Corporation, has become development engineer of the gas and Diesel engine division of the Worthington concern.

Economy!



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CATALOGS . . . BULLETINS

Helpful Publications Which Manufacturers Will Be Glad to Send Free for the Asking

Liquid Chlorine

Diamond Alkali Company, Pittsburgh, has issued a 32-page book giving complete story of liquid chlorine, including its physical constants, history, manufacture, shipping, containers, and its commercial uses as well as several diagrams of installations.

Machinery

Gosline-Birmingham Company, Inc., Birmingham, Alabama, is distributing a six-page booklet outlining the company's manufacturing facilities and listing its products, illustrations including parts of the plant and some of its products, machines and castings.

Refractories

Plibrico Jointless Firebrick Company, 1800 Kingsbury Street, Chicago, has issued a 30-page catalog describing its Plibrico jointless firebrick for furnace construction, its suspended arches, hearth and high temperature cements, its mines and factories. The well illustrated catalog includes engineering data on the products.

Hot Oil Pumps

Ingersoll-Rand Company, 11 Broadway, New York, is distributing a bulletin dealing with the Cameron Class AHT hot oil charging pumps which are high pressure centrifugal pumps designed for the sole purpose of handling the high-temperature oils encountered in cracking coil service.

Boiler Burners

Cleaver-Brooks Company, Milwaukee, Wisconsin, is distributing an illustrated bulletin dealing with its Oilbilt boiler-burner units. They are designed for steam pressures from 15 to 200 pounds and up to 150 horsepower, compact, readily accessible and suitable for a wide variety of applications.

Electric Plants

The Harnischfeger Corporation, 4400 West Avenue, Milwaukee, has published Bulletin E. P. 1, dealing with electric power and lighting plants, describing A. C. and D. C. units for use in portable service on excavation machinery, plants, construction work. Contains complete detailed specifications for manual and automatic electric starting and specifications covering large generator sets.

Welding

Hobart Brothers, Troy, New York, is distributing a new edition of "The Manual of Simplified Arc Welding," written to thoroughly cover the subject of welding. A second book "Arc Welding" also is available.

Corrosion Prevention

Frick Company, Inc., Waynesboro, Pennsylvania, has published Bulletin 164-A, 19 pages giving information selected to help plant owners and engineers in increasing useful life of any equipment that is subject to corrosion from contact with refrigerating brine.

Control

Westinghouse Electric and Manufacturing Company, East Pittsburgh, has prepared a 10-page publication fully describing its two-wire visicode and audicode supervisory control. This simplified means of securing remote indication of apparatus units is especially adaptable to central station, substation, and oil and gas pipe line station operation.

Alloys

The International Nickel Company, 67 Wall Street, New York, is distributing two technical information bulletins, bulletin T-7 dealing with properties and uses of Inconel, and Bulletin T-8 dealing with the welding of Inconel. Both are illustrated and cover their subjects from an engineering and technical viewpoint.

Steam Specialties

Chaplin Fulton Manufacturing Company, 28 South Penn, Pittsburgh, has prepared a 60-page illustrated catalog covering its Vigilant feedwater regulators, Fulton boiler-feed pump governors, gas-fuel boiler governors, water reducing valves, steam reducing valves, gauge cocks, ejectors, and pressure control equipment.

Converters

Louis Allis Company, Milwaukee, Wisconsin, has published two bulletins on converters. Bulletin No. 509-A completely illustrates and describes construction, operation and uses of various types of frequency converters. Bulletin No. 502-B describes and illustrates inverted rotary converters.

Alloy Steel

American Manganese Steel Company, 6600 Ridge Avenue, St. Louis, Missouri, has issued a bulletin dealing with Amsco Alloy, a series of cast nickel-chromium alloys for resisting heat corrosion and acids, which is available in six different analyses.

Pyrometers

Russel Electric Company, 379 West Huron Street, Chicago, is distributing a bulletin dealing with the specifications, uses, and general engineering information on its complete line of "Hold-Heet" Pyrometers.

Instruments

American Instrument Company, 774 Girard Street, N. W., Washington, D. C., has prepared Bulletin 850, dealing with its Acree Universal pH meter, which is adapted to use with glass, hydrogen, quinhydrone or antimony electrode, and with any type of solution, including colored, very dilute, weakly buffered, oxidizing or reducing and colloidal solutions.

Rotary Pumps

Worthington Pump & Machinery Corporation, Harrison, New Jersey, is distributing bulletin describing its internal bronze bearing type rotary pumps for handling liquids having lubricating value such as lubricating oils, mineral seal oils, fuel oils, and similar products.

Centrifugal Pumps

Morris Machine Works, Baldwinsville, New York, is distributing Bulletin 152, describing its line of double suction horizontally split centrifugal pumps, and outlines important advances in design within the last few years, explains details of the Morris design, and includes many illustrations and a section of engineering data.

Combustion Meter

The Hays Corporation, Michigan City, Indiana, is distributing Catalog RA-34, on combustion meters for carbon dioxide only, and carbon dioxide with combined records of overfire draft and flue gas temperature. Recorders only, indicators only, and combination carbon dioxide recorder indicators are offered in 45 types and combinations of carbon dioxide, draft and temperature records.

Instruments

Taylor Instrument Companies, Rochester, New York, has prepared a bulletin dealing with its new Fulscope recording regulators for temperature, pressure, rate of flow and liquid level.

Circuit Breakers

General Electric Company, Schenectady, New York, has issued Bulletin GEA-704D, which describes Types FK-232 and FKR-232 indoor Oil Circuit Breakers manufactured by the company. Construction and operating mechanism are shown.

Motor Pump

Ingersoll-Rand Company, Phillipsburg, New Jersey, has issued a new catalog, No. 7464, which carries announcement that the Cameron "Motorpump" is now being built in 26 sizes and in capacities ranging from five g.p.m. to 1000 g.p.m.

Boiler Feed Pumps

Ingersoll-Rand Company, Phillipsburg, New Jersey, has issued Bulletin No. 2078 which describes the Cameron Type NT multi-stage centrifugal pumps.

Electric Plants

Universal Motor Company, Oshkosh, Wisconsin, has issued literature which describes electric plants manufactured by the company. New developments and improvements are also reviewed.

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THE RIDGID handle and housing are no longer made of malleable iron. We have developed a new metal called Super-X—neither malleable nor steel—but with the advantages of both. It more than doubles the strength of the old RIDGID Wrench.

The new RIDGID All-Alloy Pipe Wrench is still unique in strength and in use-satisfaction. For instance, in 24" size, handle and housing of Super-X metal holds a load of more than 33-inch tons 9½" from the jaws. No pipe on the handle can carry enough men to equal half of that. Replaceable hook and heel jaws have always been made of chrome molybdenum nickel steel. Add all the other RIDGID advantages to this tremendous strength and you have a pipe wrench unequaled anywhere at any price. See the new RIDGID at your Supply Store.

RIDGID still has the guaranteed housing. You simply cannot warp or break it. The adjusting nut spins freely in its open socket, in every size, 6" to 60". You can't lock it on a pipe. Instant grip, instant let-go. For safety, long life, freedom from repairs and pleasure in using it, RIDGID is unequalled. Try it and see for yourself.

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PIPE WRENCHES, CUTTERS, VISES, THREADERS

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